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ABSTRACT

This document profiles the diverse approaches to tech-prep taken by 10 local districts across the United States. The tech-prep programs in the following cities are profiled: Dayton, Ohio; Dothan, Alabama; East Peoria, Illinois; Fresno, California; Gainesville, Florida; Hartford, Connecticut; Logan, West Virginia; Salem, Oregon; Springdale, Arkansas; and Springfield, Massachusetts. Each profile includes information about the following aspects of the program: articulation and programs of study; changes in curriculum and instruction; recruitment, guidance, and career development; and governance and resources. Discussed in the final chapter are the following emerging issues: students toward whom tech-prep is targeted; the importance of articulation to tech-prep development; ways consortia can make programs of study a meaningful feature of tech-prep; the implications of alternative strategies for introducing applied academics; the extent to which tech-prep will change postsecondary programs; and the role business and industry can be expected to play in tech-prep. (MN)

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DIVERSE FORMS OF TECH-PREP: IMPLEMENTATION APPROACHES IN TEN LOCAL CONSORTIA

1995

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THE DIVERSE FORMS OF TECH-PREP: IMPLEMENTATION APPROACHES IN TEN LOCAL CONSORTIA

1995

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I. INTRODUCTION

Local partnerships, guided and supported by state and federal agencies, are implementing Tech-Prep programs throughout the United States. Tech-Prep is a strategy for improving the skills and career preparation of American youth, particularly those who in recent decades might not have pursued postsecondary education. Local consortia of school districts and postsecondary institutions translate Tech-Prep reform concepts into concrete plans. To do so, they must build collaboration between high school and college faculty and administrators, develop new curricula, train teachers to adopt new approaches to instruction, purchase laboratory equipment, juggle class schedules, and tap the interest and expertise of local business, labor, and community groups. Their work is guided and supported by the federal government and state agencies. For the fiscal years 1991 through 1993, the federal government distributed more than $255 million to states to help them develop Tech-Prep programs, with the bulk of it then distributed by states to local consortia. State agencies have established the mechanism for funding local Tech-Prep consortia, provided training for local staff on Tech-Prep concepts, defined implementation approaches and guidelines, and monitored local progress. In the end, however, it is local staff--high school teachers, college instructors, counselors, and administrators--who interpret the educational theories of Tech-Prep proponents, adapt them to local constraints and circumstances, and determine the shape, scope, and pace of change achieved under the banner of Tech-Prep. This report, as part of a national evaluation of Tech-Prep sponsored by the U.S. Department of Education (ED), presents the first of several depictions of these local efforts in 10 selected sites in the United States.

Tech-Prep reform concepts were developed over the past decade by educators and have now been incorporated into federal legislation. The Tech-Prep model was first clearly formulated and popularized by Dale Parnell (1985). It emphasizes creating ***career pathways***, programs of study that link high school programs to advanced technical education in community colleges and other institutions. These pathways would help high school students plan their studies to lead to a postsecondary credential in a high-skill, high-demand occupation, and avoid redundant course work. The model stresses the use of ***applied academic curricula***--materials and instructional approaches that give students practical, hands-on ways to learn and apply concepts in math, science, and communications. In 1990, the Carl D. Perkins Vocational Education Act was amended by Congress; one amendment added Title IIIE, known as the Tech-Prep Education Act, which set forth seven elements that should be included in local Tech-Prep programs developed with the support of federal Title IIIE funds:

1. ***Articulation Agreements***. Agreements between secondary and postsecondary institutions, to establish links between students' high school and higher education programs
2. ***A 2+2 Design***. Including a common core of math, science, communications and technology in high school, followed by more advanced specialized courses in a four-year program sequence spanning high school and postsecondary study
3. ***A Tech-Prep Curriculum***. Tailored to local student needs and institutional constraints
4. ***Joint Staff Development for Secondary and Postsecondary Instructors***. To promote cooperation and maximize the "seamlessness" of overall curriculum content for students making the transition from high school to postsecondary study
5. ***Training for Secondary and Postsecondary Counselors***. Training on how to attract students to Tech-Prep, promote retention, and guide students to career employment
6. ***Measures to Ensure Access***. For special populations such as minorities and at-risk students
7. ***Preparatory Services***. Services such as recruiting, counseling, and assessment, to help students understand Tech-Prep and make decisions about programs of study and career direction

To chart progress in the development of programs with these features, ED is conducting a five-year national Evaluation of the Tech-Prep Education Program, mandated by Congress in the 1990 Perkins Act amendments. The evaluation, which is being conducted under contract by Mathematica Policy Research, Inc. (MPR) and its subcontractor Northwest Regional Educational Laboratory (NWREL), has two objectives. First, it will describe Tech-Prep programs--documenting their numbers and characteristics, the institutions involved, the populations served, and planning and implementation efforts. Second, it will identify effective implementation practices, over the full period of the evaluation, to provide guidance for state agencies and local consortia. These objectives are being pursued in three major data collection efforts:

1. *A survey of state-level Tech-Prep coordinators*--in fall 1993 and fall 1996
2. *A survey of local Tech-Prep consortia*--annually for four years beginning in fall 1993
3. *In-depth studies of 10 selected local programs*---involving four annual rounds of data collection beginning in the 1993-1994 school year

This report begins a four-year sequence of "in-depth study" reports documenting the approaches, progress, difficulties, and creative solutions and innovations of 10 local Tech-Prep consortia, identified in Table I.1.[1] These reports will be based on several types of data. In annual site visits typically lasting three or four days, evaluation staff conduct discussion-style interviews with a wide range of key individuals--high school and college administrators and faculty, counselors, representatives of actively involved employers and labor or community groups, and the consortium coordinator. Evaluation staff also conduct focus groups with students participating in Tech-Prep, and observe classes (including those involving vocational or technical instruction and academic classes affected by Tech-Prep curriculum development). The first round of site visits--the basis for this report--was conducted in the late fall of 1993. In addition, in each consortium, the progress of two cohorts of students identified as Tech-Prep participants--entering the 11th grade in the fall of 1993 and 1994--will be documented on the basis of school records collected from their high schools and, potentially, their colleges.

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[1] A parallel series of reports based on the nationwide surveys of state and local Tech-Prep coordinators will be the other major product of the evaluation. The first of these reports, titled "The Emergence of Tech-Prep at the State and Local Levels" (Silverberg and Hershey 1994) presents results from the first surveys, conducted in the fall of 1993.

TABLE I.1

LOCAL TECH-PREP CONSORTIA INCLUDED IN THE IN-DEPTH STUDY

Consortium Location/Name	Secondary and Postsecondary Partners	Secondary Participation, Fall 1993[a]	Definition of Program Participation
Dayton, Ohio Miami Valley Tech-Prep Consortium	Sinclair Community College Miami Jacobs College 8 vocational education planning districts (3 joint vocational centers)	51	- In grade 11 - Completed a Tech-Prep application - Enrolled in articulated vocational program - Taking at least 1 applied academic class
Dothan, Alabama Dothan City Schools Tech-Prep Consortium	Wallace College Dothan City Schools (2 academic high schools, 1 vocational center)	--	- Tech-Prep students identified as those lacking appropriate credits at start of 11th grade for university entrance credit[b]
East Peoria, Illinois Central Illinois Consortium	Illinois Central College 19 high schools in 3 regional delivery systems	--	- Definition not yet developed
Fresno, California State Center Tech-Prep Consortium	State Center Community College (2 campuses) 19 school districts (29 high schools)	--	- No identification or counting of Tech-Prep students
Gainesville, Florida Santa Fe Community College Consortium	Santa Fe Community College Alachua County Schools (8 high schools) Bradford County Schools (1 high school, 1 technical center)) St. Leo's College (4-year)	2,000	- In grades 9-12 - Enrolled in articulated vocational program - Taking at least 1 applied academic course
Hartford, Connecticut Capital Community College Tech-Prep Consortium	Capital Community-Technical College Hartford Public Schools (3 high schools) 4 suburban school districts (4 high schools) 1 area vocational technical school	140[c]	- In grades 11-12 - C average through 10th grade - Fewer than 10 absences in previous semester
Logan, West Virginia Southern West Virginia Community College Tech-Prep Consortium	Southern West Virginia Community College Logan County and Mingo County Schools (2 vocational schools, 3 high schools, 8 junior high schools)	200	- In grades 9-12 - Specified scores on aptitude tests in eighth grade - Suitable interest profile - C or better in math/English
Salem, Oregon Mid-Willamette Education Consortium	Chemeketa Community College 22 school districts (26 high schools) in 3 county education service districts	16,000	- In grades 9-12 - Enrolled in any single articulated vocational course
Springdale, Arkansas Springdale Tech-Prep Consortium	Northwest Arkansas Community College Northwest Technical Institute Springdale School District (1 high school)	--	- Tech-Prep students not identified
Springfield, Massachusetts Tech-Prep West	Springfield Technical Community College Holyoke Community College Greenfield Community College 8 vocational high schools in 8 local or area districts University of Massachusetts/Amherst Westfield State College	414	- In grades 11-12 - Enrolled in articulated vocational program - Taking at least 1 applied academic course

[a] In fall 1993, no students at any of the sites had progressed from the secondary to the postsecondary level.

[b] Components of Tech-Prep in Dothan have been phased in over several years. The first group of Tech-Prep students was identified in spring 1994.

[c] The estimate of participation in the Hartford consortium includes only the Hartford schools.

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The 10 consortia included in the in-depth study were selected to reflect the diversity of Tech-Prep program settings and of the stages of development the programs have reached. Emphasis was placed on choosing sites from different geographic regions and from both urban and rural locations. We also sought to include some relatively mature programs as well as some in earlier stages of development. The evaluation team solicited nominations of study sites from state coordinators, an evaluation advisory group that included state and local educators active in developing and monitoring Tech-Prep programs, and other informed parties. These parties nominated local consortia that had already made outstanding implementation progress and some that had developed strong implementation plans.[2] The evaluation team, in consultation with ED, then chose 10 sites in diverse locations from among these nominees.[3]

This report represents a first step in documenting the progress of these 10 consortia and identifying effective implementation practices. It presents a basic description of the status of each consortium, as determined in the initial fall 1993 site visits. In the following 10 chapters, a profile is presented of each consortium, focusing on four dimensions of Tech-Prep development efforts: (1) articulation; (2) enhancement of curriculum and instruction; (3) approaches to recruiting, guidance, and career development; and (4) the governance structures created to organize consortium activities and coordinate use of grant funds. These four broad categories provide a consistent framework for describing the very diverse ways that local consortia approach Tech-Prep implementation, and encompass all of the key Tech-Prep concepts. Table I.2 summarizes the features

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[2] However, we excluded from consideration consortia that had been designated as federal demonstration sites, since they are already being showcased and their staff challenged by the demands of widespread interest.

[3] Consortia were only considered for the in-depth study, however, if it appeared that they would be able to identify, in the fall of 1993 and 1994, groups of 11th-grade Tech-Prep students whose school outcomes could be tracked over the subsequent years of the evaluation. A goal was set of studying 75 students from a single school in each cohort at each site, but this standard was relaxed, as shown in Table I.1, to allow inclusion of promising small consortia still in the early stages of implementation.

TABLE I.2

KEY PROGRAM FEATURES OF TECH-PREP AT IN-DEPTH STUDY SITES

Articulation and Programs of Study	Changes in Curriculum and Instruction	Recruiting, Guidance, and Career Development
DAYTON, OHIO: MIAMI VALLEY TECH-PREP CONSORTIUM		
New emphasis on advanced skills model of articulation Credit for college-level occupational courses in high school Initial focus on electronic engineering and manufacturing technology	Full-day occupational and academic program at technical center New courses with broad exposure to technology of two industries Teams of academic teachers and occupational instructor to integrate instruction	Targeted to students with interest in postsecondary education, math/mechanical aptitude, and interest in science Students drawn from 34 high schools to programs at technical centers; full-day recruiting event in spring of 10th grade Employability skills and behavior used as input to course grades
DOTHAN, ALABAMA: CAREER QUEST		
Agreements reached by 1993-1994 articulating business and most other vocational courses College credit based on grade of A in high school course or on challenge exam if grade is B All students choose one of four broad career clusters at end of ninth grade	Increased local graduation requirements in math, English, science, social studies Required one-semester class in 10th grade: introduction to chosen cluster industry Students who will not meet four-year college entrance requirements required in 11th grade to choose occupational specialty at technical center; some vocational courses upgraded Applied academics classes available for all students; counselors recommend to appropriate students	Tech-Prep viewed as general reforms affecting all students Career exploration and guidance reforms affecting all students starting in seventh grade Full-year class for all 9th-graders on career exploration, computer literacy, and work readiness Intent to upgrade image of technical careers and vocational center
EAST PEORIA, ILLINOIS: CENTRAL ILLINOIS CONSORTIUM		
Programs of study-specify academic and vocational high school courses for five defined clusters, leading to 23 occupationally oriented college programs Agreements established articulating 17 high school occupational courses to college courses Articulation credit requires grade of B in high school course and C in next college course	Some high schools raising academic requirements and introducing applied academics classes Revision of some college technical courses Emphasis on interdisciplinary cooperative projects involving teachers and students from different classes	Tech-Prep viewed as general reforms affecting all students General promotion of planning for the future, value of technical careers Plan to have students with clear interest in occupation requiring associate's degree choose career cluster in 11th grade
FRESNO, CALIFORNIA: STATE CENTER TECH-PREP CONSORTIUM		
Existing articulation: Hundreds of agreements between college and 19 local school districts Articulation is major Tech-Prep component widely adopted in consortium College credit awarded based on C in high school course and completion of 12 subsequent college credits with 2.0 GPA	Emphasis on curriculum integration, with diverse interpretations across schools College district coordinates statewide training on CORD applied curricula Consortium staff promote applied approach in all academic classes and interdisciplinary teaching and projects Some enhancements of high school vocational classes as part of articulation	Emphasis on promoting general reforms rather than developing Tech-Prep programs in specific occupational areas Increasing emphasis on improving career awareness and work readiness, approached in diverse ways by individual schools In a few schools, career pathways defined and promoted, involving sequences of related and useful courses

TABLE 1.2 *(continued)*

Articulation and Programs of Study	Changes in Curriculum and Instruction	Recruiting, Guidance, and Career Development
GAINESVILLE, FLORIDA: THE SANTA FE COMMUNITY COLLEGE CONSORTIUM		
About 35 programs of study specifying secondary and community college academic and occupational courses College credit for high school courses awarded only if student completes entire secondary portion of program of study Programs of study designed with multiple exit points to one-year postsecondary certificates, associate's degrees, and four-year programs	More math, English, and science required than in previous general and vocational education tracks Gradual introduction of applied math, biochemistry, and communications in high schools Faculty exchanges between college and high schools Health Academy magnet program, involving team of teachers and systematic workplace activities	Students choose at end of eighth grade (and sometimes later) between University Prep and college-prep (Tech-Prep) College presentations at high schools to recruit for dual enrollment programs Increased emphasis on community college option by high school guidance counselors Intensive public relations on Tech-Prep, technical careers, and community college Summer college programs to attract females and minorities to technical programs
HARTFORD, CONNECTICUT: CAPITAL REGION TECH-PREP CONSORTIUM		
Career clusters: manufacturing technology, health careers, child care, law enforcement, culinary arts Clusters include articulated academic and vocational courses; in some instances, no relevant vocational course Articulation between Hartford Public Schools and Capital Community Technical College, as well as other nearby community colleges College grants credit for articulated high school courses, based on course grade of C	Upgrading of some vocational courses to meet requirements for college credit Various applied academics classes introduced as suggested parts of career cluster sequences: applied physics and communications Plans to require advanced math class in manufacturing technology cluster	College emphasis on clear standards for admission to Tech-Prep, based on GPA, attendance, participation in summer and after-school enrichment, and other procedural requirements Low-key recruiting to Tech-Prep clusters within the high schools Students considered in Tech-Prep if enrolled in articulated vocational course
LOGAN, WEST VIRGINIA: SOUTHERN WEST VIRGINIA COMMUNITY COLLEGE CONSORTIUM		
No articulation or college credit in high school First program of study in electronics and electrical engineering; plans for program in water quality and waste water management Program defines required vocational and academic courses in high school and college	Entirely new vocational curricula at high school and college Applied Math, Principles of Technology, and Applied Communications in grades 11-12; available to all students; required for Tech-Prep Keyboard/computer skills in grade 9 or 10	Marketing of Tech-Prep as distinct from regular vocational programs Students selected in two stages, based on 9th-grade test scores and performance in math and English Plans for worksite visits and internships

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TABLE I.2 *(continued)*

Articulation and Programs of Study	Changes in Curriculum and Instruction	Recruiting, Guidance, and Career Development
SALEM, OREGON: MID-WILLAMETTE EDUCATION CONSORTIUM		
Tech-Prep part of statewide reform to establish Certificates of Initial Mastery and Certificates of Advanced Mastery (CAM) in general career areas Articulation between at least one high school and the college for 12 college occupational programs; agreements link individual courses College credit awarded based on competency exam or portfolio assessment, depending on course	Efforts beginning to define pathways in each occupational area--recommended course sequences leading to CAM Limited introduction of applied academic classes in 20 of 27 high schools Applied classes open to all students but in some schools recommended mostly to students with academic problems Initial efforts to make college classes more relevant to particular occupations	Tech-Prep a reform concept, not a program No recruiting to Tech-Prep or student identification with Tech-Prep Tech-Prep population loosely identified as all students in an articulated occupational course Varied approaches to improved guidance and career development: career centers, guest speakers, interest inventories, career planning software, pilot project to create employer database for worksite placements
SPRINGDALE, ARKANSAS: NORTHWEST ARKANSAS TECH-PREP CONSORTIUM		
Six-year course sequences defined for 14 occupations, spanning high school and community college, including academic, occupational, and career development courses Course-to-course articulation; college credit earned based on specified grades in articulated high school courses	Focus on introducing more applied content and instruction in high school Math Tech, Principles of Technology, and English Tech implemented in varying degrees in consortium districts	Strengthening of guidance for all students, involving teachers as advisers with support from regular counselors No distinct Tech-Prep program Plans for youth apprenticeship worksite placements in banking and finance
SPRINGFIELD, MASSACHUSETTS: TECH-PREP WEST		
About 17 college programs articulated to high school courses College credit awarded based on grade in high school vocational sequence or challenge exam for additional credit	Emphasis on strengthening math, science, and English for students in vocational programs or vocational high schools Gradual introduction of Tech-Prep Math, Principles of Technology, and applied concepts in English classes	Students who choose vocational programs in ninth grade deemed in Tech-Prep if they take applied academic classes Counselor visits high schools; promotes technical careers and college planning Summer programs to attract females to technical programs. Worksite placements for nurse's aide program, occasional workplace tours

of the 10 consortia with regard to the first three of these dimensions, which represent their major programmatic characteristics.

We have drawn the following preliminary findings about these four dimensions of program development from the first round of site visits:

- ***Articulation and Programs of Study.*** Articulation agreements are a major defining feature of Tech-Prep in most sites. Most consortia have built their Tech-Prep development on earlier articulation, and some are currently expanding articulation to new schools and occupational areas. A few consortia have adopted articulation of academic courses. In most sites, articulation links individual courses at the high school and college level. A few consortia have created broader programs of study that include sequences of technical and academic courses for students with particular career interests, but others are making progress toward that goal.

- ***Changes in Curriculum and Instruction.*** Although most of the ten consortia have taken some steps to upgrade vocational curricula, most curriculum change has focused on the introduction of applied approaches to teaching math, science, and English. Most sites have adopted commercially available curriculum packages or incorporated modules from them into existing courses. Consortia have used applied curricula quite differently. Some encourage all vocational students to take applied academics classes, or just those students who are enrolled in vocational programs designated as Tech-Prep. Other consortia make applied courses generally available to all students, and rely on counselors to guide into these courses the students for whom they seem most appropriate. Applied math and English classes, under this latter approach, are most commonly serving lower-ability students, whereas applied science courses in some cases are attracting a mix of students with diverse abilities and educational aspirations.

- ***Recruiting, Guidance, and Career Development.*** Some of the ten consortia have defined Tech-Prep as a distinct, high-tech form of vocational education, for only some occupations and a small, carefully selected group of students. These sites have paid close attention to recruiting well-qualified students, who consciously choose a Tech-Prep occupational program. In other sites, Tech-Prep is primarily an upgrading of vocational programs with the addition of applied academics courses; students in those sites are much less conscious of being in a special program. A few sites treat Tech-Prep as a foundation for general school reform and do not recruit students at all; instead, they provide career development activities for all students, and are promoting the value of career-oriented programs of study for all students, whether or not they include vocational courses.

- ***Governance and Resources.*** The in-depth study sites have a variety of structures for planning and coordinating Tech-Prep development. Several consortia have formal and quite extensive structures of committees and specialized subcommittees, including secondary and college staff, and teachers, administrators, counselors, and employer and community representatives. In other sites, responsibility for Tech-Prep has been folded into regular school district operations, and there is little ongoing interaction between secondary and college staff. All the sites have at least one staff person serving as a consortium coordinator, and in a few sites several individuals serve as a collective

> coordinating body. Annual implementation grants to the local consortia vary widely in amount, from as little as about $20,000 per year to more than $260,000, reflecting differences in consortium size and complexity as well as state funding practices.

These findings, we must caution, provide only an initial interpretation of what these ten consortia are achieving. They are based on only the first of four site visits. In many cases, the profiles draw heavily on information pertaining to only some of the member schools or colleges, because of inevitable limits on what could be explored in a first visit. Moreover, each consortium is developing from year to year; subsequent visits will provide a basis for reporting on changes, as well as for exploring more thoroughly the range of approaches and implementation progress within each consortium.

The likelihood that considerable change remains to be observed makes it useful now to identify issues that merit particular attention in the future. In the final chapter of this report, we identify and discuss six issues that are likely to affect the longer-term strength of Tech-Prep implementation:

1. Whom is Tech-Prep for?
2. How central is articulation to Tech-Prep development?
3. How can consortia make programs of study a meaningful feature of Tech-Prep?
4. What are the implications of alternative strategies for introducing applied academic instruction?
5. How much will Tech-Prep change postsecondary programs?
6. What contributions can be expected of employers in the development of Tech-Prep programs?

Although we have identified these issues in the initial observation of the ten in-depth study sites, they are likely to arise in the development of Tech-Prep in many other consortia. These issues will be analyzed further in later reports, as more information becomes available on how the in-depth study sites address them. These later analyses will highlight particularly effective approaches to common challenges of Tech-Prep implementation.

II. DAYTON, OHIO

The Miami Valley Tech-Prep consortium is large and diverse. At the secondary level, it includes eight vocational education planning districts (VEPDs) and three joint vocational centers serving 50 high schools in seven western Ohio counties--Butler, Dark, Greene, Miami, Montgomery, Preble, and Warren. These counties encompass the Dayton urban area as well as rural farming communities. The postsecondary partners in the consortium are Sinclair Community College (SCC) and Miami Jacobs Junior College (a small business college), but program links are also being formed with the University of Dayton. The consortium is centered around SCC, a college that has grown during the past 20 years into a well-known advanced technology center housing 60 laboratories. The pace of Tech-Prep implementation varies widely within the consortium. In school year 1993-1994, two of the three joint vocational centers had begun enrolling students: (1) the Greene County Career Center (GCCC), serving seven high schools; and (2) the Montgomery County Joint Vocational Center (MCJVC), serving 27 high schools. This initial profile depicts program development early in the first year of implementation in SCC and these two joint vocational technical centers, the former located in Xenia and the latter in Clayton, both near Dayton.

The Dayton area is in a general economic downswing, but strong demand for some technical skills remains. Several large firms have recently left the area or cut their work forces. NCR, a prominent Dayton employer in the 1980s, has been acquired by AT&T, and has moved its manufacturing operation out of the area, leaving only its headquarters office in Dayton. General Motors has cut employment in the area to a third of its peak payroll. However, the number of job openings is actually growing in two fields that were an early focus for Tech-Prep development: (1) electronic engineering technology; and (2) manufacturing technology. Despite numerous local layoffs in manufacturing, the Ohio Bureau of Employment Services projects annual demand in the Dayton area for 62 new electronics technicians and 77 new tool and die makers. These projections are corroborated by recent SCC placements. SCC has a three-year placement rate of 80 percent for graduates of its electrical engineering technology program and an eight-year record of 100 percent placement for graduates of its manufacturing technology program.

Tech-Prep's emphasis on competencies is consistent with the key principles of recent state-level education reforms. Under a statewide mandate emphasizing educational outcomes in language arts and mathematics, students now take achievement tests in grades 4, 6, and 9, and competency tests in grades 9 and 12. They must also pass the ninth-grade competency test to graduate from high school. The emerging Miami Valley Tech-Prep program's emphasis on identifying, teaching, and measuring occupationally relevant competencies has attracted the attention of area educators eager to realize the principles of these state reforms.

Program development in the Miami Valley consortium is also heavily influenced by the way state staff have defined Tech-Prep and its relation to vocational education. Vocational education will continue to serve secondary students who want to enter a specific occupation, such as welding, immediately after high school. Tech-Prep, in contrast, is viewed as a more broadly defined technology program for high school students interested in postsecondary education, including but potentially extending beyond two-year degree programs. Tech-Prep is thus being defined at the state and local levels as a relatively selective program that, compared with vocational education, will pose greater academic demands, particularly in mathematics and science, and provide a comprehensive technical foundation rather than mastery of particular technical skills.

A. ARTICULATION AND PROGRAMS OF STUDY

Creating Tech-Prep in the Miami Valley has involved three programmatic changes: (1) a shift to an enhanced skill version of articulation; (2) the introduction of a single-site program combining academic and technical instruction; and (3) the introduction of broadly defined technology courses.

Full implementation of Tech-Prep as planned will build on articulation agreements already in place between SCC and some of the consortium high schools. Beginning in the late 1980s, some schools reached agreements with the college that allowed college credit to be granted for completion of existing occupational courses at the high school level or attainment of satisfactory scores on college placement or "challenge" exams. These agreements shortened the time required for students to obtain an associate's degree. After considerable debate, the consortium's leadership decided to strive instead to incorporate an "enhanced skills" model of articulation in the Tech-Prep program. They encountered some initial resistance; small manufacturers in the Dayton Tool Machine Association agreed that students needed to be well-grounded in math, science, grammar, teamwork habits, and communications skills, but they doubted their ability to afford the higher wages that graduates of a program stressing advanced technical skills would demand. This skepticism was successfully countered, however, by some executives of local manufacturing research firms who preferred to hire college graduates, even for shop floor positions, because of their superior problem-solving skills.

Implementing the enhanced skills model involves modifying the concept of articulation. Revised articulation agreements will be developed to allow Tech-Prep students to earn credit in high school toward an enhanced skills or honors diploma at SCC. This program will require that they take more advanced college course material than non-Tech-Prep students. Plans are also being made for the enhanced skills program at the college to include 12 credits earned in work-site training. However, the details of these changes in articulation and postsecondary programs must still be defined, as must the pace at which articulation changes will be adopted by the consortium's remaining high schools.

Students who are selected for Tech-Prep after 10th grade attend a two-year, full-day program at one of the joint vocational centers for 11th and 12th grades. In school year 1993-1994, the MCJVC offered programs in both electronic engineering technology and manufacturing technology, while the GCCC offered only the manufacturing technology program. Regular vocational students also attend both academic and vocational classes at the technical centers, but Tech-Prep students take more demanding academic classes. They attend college-prep level academic classes in the morning, and two periods of occupational class in the afternoon. They will be required to take some applied academics classes, but the strategy for incorporating applied curricula into their program is still taking shape.

Local educators and employers have developed the technical courses that Tech-Prep students take in 11th and 12th grades to provide a broad introduction to various technical skills relevant to the students' chosen occupational area. In manufacturing technology, for example, students take drafting their first semester in 11th grade. They then rotate during the next three semesters through segments in welding, electronics, plastics, machines and motor controls, and hydraulics. This program is quite different from a regular vocational program, in which students would, for example, focus on only one more narrowly defined occupation.

The overall program of study that students choose consists of the revised secondary program and the existing SCC associate's degree program. The manufacturing technology program, for example, can lead them at the college level to programs in electromechanical engineering and robotics, computer-integrated manufacturing, advanced tool and die making, metalworking, CAD/CAM, and quality control. Although students are given extensive information about the postsecondary program options to which their high school Tech-Prep program can lead, the choice they make when they enter Tech-Prep in 11th grade focuses primarily on their two-year secondary program.

The coming years will bring a broader array of technical career areas into the Tech-Prep program in the Miami Valley consortium. Programs in health occupations and automotive technology are being developed and are expected to begin enrolling students in school year 1994-1995.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Introducing the first two Tech-Prep programs of study has involved substantial changes in both academic and occupational content and instruction. A start has been made on five changes: (1) creating a team of academic teachers for Tech-Prep students; (2) introducing applied and occupationally relevant material in academic classes; (3) creating increased cooperation between academic and occupational instructors; (4) developing the new technical curricula; and (5) involving students in hands-on projects requiring cooperation with other occupational programs and work-site activity.

Although the concept is only partially realized, consortium leaders are planning an interdisciplinary academic curriculum. GCCC has taken a step toward this goal by forming a team consisting of four teachers--in math, science, English, and employability skills--to work with the manufacturing technology students each morning.

Some changes are being planned, or are in the early stages of implementation, to make material more relevant to students' technical direction and to provide greater opportunities for hands-on learning. In fall 1993, plans had been made to acquire applied academics curricula, such as Principles of Technology, Applied Math, and Applied Communications. Efforts were also under way to revise math and science classes to show relationships between academic concepts and vocational applications; these efforts included selection of textbooks with occupationally relevant applications. One GCCC student, for example, pointed out that the mathematics textbook he was using included exercises involving machining diagrams.

The consortium has also created greater opportunities for cooperation between academic and occupational instructors. Students stay in the same classroom area all morning, and their academic instructors rotate through the classroom. The occupational instructors sometimes join the math teacher. Between the teaming of academic teachers and the additional attention from the occupational instructor, students often find themselves with two or even three instructors in their math class at a time. Students report that this situation allows them to receive valuable individual attention.

Development of the new technical course curricula has been a major joint effort involving both educators and industry representatives. The manufacturing technology curriculum is being designed in cooperation with the Ohio Tooling and Machining Association (OTMA), which will be working to replicate it in other Ohio cities after the Miami Valley consortium demonstrates its utility.

Consortium staff first asked industry practitioners from OTMA and the Tech-Prep advisory council to develop a list of academic, occupational, and employability competencies that would be expected of entry-level employees who had completed high school or community college programs. Secondary and postsecondary representatives on the curriculum development committee then determined which of these competencies should be mastered at the secondary and postsecondary levels. On the basis of these competency lists, high school and college staff are defining course objectives together, making decisions to purchase some commercially available applied curricula, and building lesson plans for the academic and occupational classes to be taught in 11th and 12th grades, emphasizing contextual material and instructional approaches. A similar process was used to develop the academic and occupational curricula for students in electronic engineering technology.

The program for Tech-Prep students at the secondary level is expected to incorporate hands-on projects and workplace experience. In school year 1993-1994, all Tech-Prep students were expected to take part in a project at their school involving cooperation among several occupational disciplines (some that are considered part of Tech-Prep and others that are part of the vocational education program). Plans were also being made for students to take part in a project based at an industry site in 1994-1995. However, the details of these activities had not yet been defined as of fall 1993.

Although postsecondary administrators and instructors have had substantial involvement in developing the Tech-Prep curricula for the secondary level, there was no evidence yet in fall 1993 of changes in postsecondary curriculum. Community college instructors in several specialty areas that might attract Tech-Prep students pointed out that existing college curricula have been developed to meet industrial standards. Changing these curricula, they believed, would decrease students' chances of achieving industry certification. Other instructors, however, favored the idea of revising programs to teach more advanced skills to college students, if they receive strong preparation in high school, and were planning for implementation in 1994 of some new advanced skill courses.

C. RECRUITMENT, GUIDANCE, AND CAREER DEVELOPMENT

To attract students with the required motivation and skills into Tech-Prep, the Miami Valley consortium has adopted a careful marketing and recruiting plan. The plan involves five components: (1) researching parents' attitudes about technical education; (2) carefully specifying the target student population; (3) nominating potential Tech-Prep students; (4) promoting Tech-Prep potential students; and (5) providing intensive orientation for students who apply for Tech-Prep.

Consortium staff laid a foundation for student recruiting by assessing parent attitudes. In 1993, they employed a market research firm to conduct two focus groups with parents to determine their attitudes about school, vocational education, and work preparation. The major finding of this study was that parents would support technical education for their high-school-age children only if it did not reduce their chances of attending college. This finding had an important influence on the decision to concentrate on making Tech-Prep a rigorous, high-skill program with a clear focus on preparation for postsecondary study.

To realize this vision of a high-skill program, staff then developed a description of likely student candidates for Tech-Prep. Staff distributed this description to counselors and teachers in the GCCC feeder schools and discussed it with them. This profile specified that potential Tech-Prep students should be interested in postsecondary education, have at least average ability in mathematics, have completed algebra I, prefer a hands-on approach to instruction, be interested in science, and have some mechanical aptitude. The profile also specified that students must have passed the Ohio ninth-grade math competency test to enter Tech-Prep, in order to minimize the need for remediation of basic skills. However, it omitted any requirements pertaining to grade point average in order to avoid excluding students with appropriate aptitude, motivation, and ability to master technical competencies, who may have performed poorly in standard academic classes.

Teachers and counselors at the 34 schools served by the two technical centers then nominated students they thought would be well suited to the Tech-Prep program. Counselors also reviewed the career plans of potential nominees. They interviewed likely candidates to tell them about the program design--explaining that the program involved two years of college after high school, emphasized hands-on instruction, and involved job shadowing, part-time jobs, and a technical curriculum combining skills from several occupations. On the basis of a review of students' records and these interviews, each school was asked to nominate five students in the early spring of 1993.

Consortium staff then held "Tech-Prep awareness days" for students and parents to promote interest among the nominated students. In April and May, separate full-day programs running from 8:45 A.M. to 5:00 P.M. were held for students nominated for the electronic engineering program or the manufacturing technology program. Prospective teachers welcomed students at the joint vocational centers and gave tours of the Tech-Prep labs. Students then toured local worksites in the target industries and visited SCC to meet instructors, tour the college labs, and take part in a general question-and-answer period. About 150 Tech-Prep nominees participated in these promotional sessions and could then apply for Tech-Prep and sign up for a four-day summer orientation.

A total of 51 of these students participated in the intensive summer orientation program, which was designed to maintain their interest in and excitement about Tech-Prep and to build a spirit of identification with the program. The orientation included a variety of activities. Employer representatives spoke to students, and students visited worksites. One company produced a video of students and school staff touring its plant with plant supervisors and union members. Students spent a day and a half at the community college, doing small lab projects and taking a college admissions test to identify areas in which their skills required reinforcement and to qualify as a community college student during their high school years. They spent a half day at the University of Dayton, a day in job shadowing at one of 11 participating companies, and a day in the MCJVC labs. A dinner was held for students and parents, followed by bowling and other recreation. All of the 51 students who attended this orientation enrolled in Tech-Prep in the fall--12 at GCCC and 17 at JVC in manufacturing technology, and 22 in the MCJVC electronics engineering program. This intensive and thorough approach to recruiting students and building program identification appears to have had some of the desired effects. Students who took part in fall 1993 focus groups seemed pleased with their status as Tech-Prep students, spoke with conviction of the benefits they expect from the program, and voiced their appreciation of the program's high expectations and the attention they were receiving.

Some effort has reportedly been made to promote participation in Tech-Prep among females, minority students, and economically disadvantaged students, but the success of these efforts is not yet clear. A college faculty member working under a separate grant to attract women into engineering met with some 10th-grade female students at the two joint vocational centers. In the first year, however, there were only three or four women in the Tech-Prep electronics program and one in manufacturing technology. The population served in the consortium schools is primarily white, and the same is true of the students participating in Tech-Prep.

Once students enter the Tech-Prep program, staff emphasize the development of general employability skills as a key part of career development. The employability teacher grades each student every day on attendance, performance, participation, cooperation, dependability, appropriate dress, and preparation of tools, discussing problems with students daily. One day a week, students are expected to dress as if they were working as engineers or other professional or skilled workers; for male students this means wearing a tie, for example. Although students at first felt uncomfortable dressing up, focus groups revealed that at least some now feel that this practice distinguishes them in a positive way as Tech-Prep students, and helps them get accustomed to thinking of themselves as future professionals.

D. GOVERNANCE AND RESOURCES

The Miami Valley consortium plans and carries out its work through four types of committees, supported by a full-time consortium staff. This structure includes an executive committee, an advisory council, and two types of working committees--program steering committees and functional committees. The staff includes a full-time coordinator and secretary, as well as a part-time assistant coordinator who will also coordinate an apprenticeship program planned for 1994-1995.

The consortium's executive committee monitors overall progress of Tech-Prep implementation and expenditures. The committee includes the presidents of SCC and Miami Jacobs College, as well as the superintendents of the seven actively participating school districts. The SCC president has a particularly appropriate background for this leadership role: as a former district superintendent and chairman elect of the board of the Center for Occupational Research and Development, he is well aware of the implementation challenges facing secondary schools, as well as the latest approaches to integrating academic and vocational education.

The advisory council, which meets three times each year, was formed to help with consortiumwide program planning. Its 30 members include the college deans, as well as representatives from each of the seven vocational education planning districts, the University of Dayton, business, industry, labor groups, and the community at large. The council deals primarily with marketing strategies, staff training, program evaluation, and the consortium budget.

A program steering committee has been formed for each of the two technical areas included in Tech-Prep in 1993-1994: (1) electronics engineering; and (2) manufacturing technology. Each committee includes the relevant departmental chair from SCC, a vocational education supervisor from each joint vocational center, academic and vocational instructors, and industry representatives. These committees are responsible for overall program implementation--developing curricula, recruiting, assessing students, and integrating academic skills instruction in vocational education.

Functional or standing committees address consortiumwide implementation concerns. Committees have been formed to deal with staff development, marketing, evaluation and maintenance of student tracking data, evaluation of equipment requests, and development of pre-Tech-Prep curricula. Committee members are drawn from members of the advisory council and other appointed representatives from the consortium.

The Miami Valley consortium is combining funding from several sources to maintain progress on its overall plan. For the three years beginning with school year 1991-1992, it received a total of $525,000 in Title IIIE funding, including $132,000 for 1993-1994. A school-to-work transition grant from the state of Ohio has been received to support implementation of the automotive technology cluster. Additional Tech-Prep funding from the state of Ohio is expected to support implementation of the health occupations cluster. Further development of Tech-Prep thus seems likely, even after Title IIIE funding ends.

III. DOTHAN, ALABAMA

The Dothan City Schools have been working with nearby Wallace Community College on vocational education improvements that have evolved into a more broadly defined initiative called "Career Quest." This endeavor has been strongly supported by the state director of vocational education and the state Tech-Prep coordinator. The collaboration among the college, the district, and the district's part-day vocational center, two high schools, and four middle schools began as a citywide effort several years before the 1990 Perkins Amendments made Title IIIE grants available. With the advent of Tech-Prep funding, other secondary school districts in the counties surrounding Dothan began to develop links with postsecondary institutions, including Wallace Community College.

In 1993, the state Department of Education ruled that each Alabama community college could be a member of only one Tech-Prep consortium. The college's two partnerships were then merged to form a new Tech-Prep consortium that includes Dothan and two neighboring county districts, which together add eight high schools to the consortium. The college is the fiscal agent and distributes funds to all three districts. Yet, wide differences in the stage and direction of Tech-Prep development between Dothan and the other districts have effectively created two mini-consortia. This initial profile focuses only on Career Quest--the collaboration between Dothan City Schools and Wallace Community College.

The southeastern Alabama area around Dothan--the sixth largest city in the state--has both expanding and contracting economic sectors. In recent years, retirement communities have been established in Dothan and the surrounding areas, which are served by two large hospitals and many nursing homes. The influx of a large elderly population has increased demand for health services and improved opportunities for employment in health occupations. On the other hand, the manufacturing sector has been declining somewhat. Local plants operated by Sony, General Electric, TRW, and Michelin reduced their payrolls in the early 1990s. Still, there remains a substantial demand for qualified industrial services workers--mechanics, electrical technicians, and others--to service and repair equipment and machinery.

Career Quest was preceded by only limited, informal relationships among the key partners. Instructors from the Dothan Vocational Center (DVC) and the technical programs at Wallace Community College had long been members of each other's advisory councils, along with business representatives. Some corporations in the area had been donating materials to DVC, fixing its equipment, giving plant tours, and employing cooperative education students in their machine shops. Sony had "adopted" one of the high schools and provided some special events for its students.

Beginning in 1989, more focused collaboration among the schools, the college, and business partners led to the formulation of the Career Quest plan. A common interest in improving vocational education brought the partners together and broadened into an initiative to provide enhanced career guidance to all students. Representatives from corporations on the Dothan-Houston County Chamber of Commerce Education Committee first provided the impetus for improvements, approaching district supervisors about the importance of upgrading the quality of vocational instruction. A group of teachers and counselors, staff from the community college, and business representatives investigated past research and strategies and in 1990 proposed that reform efforts be based on the Tech-Prep model being developed by the Center for Occupational Research and Development (CORD). The district, however, concluded that features of Tech-Prep--applied academics, use of career clusters to structure course work around occupational goals, and career exposure to help students make choices--would benefit all students. District staff favored including all students in career exploration and cluster choices for a second reason: to ensure that these activities would not be narrowly identified with vocational education and thus stigmatized in parents' and students' eyes. The district and its partners adopted a plan to encourage every student to explore a career and to begin planning for it in high school. This broader goal led the district to change the name of the initiative from Tech-Prep to Career Quest.

The changes resulting from implementation of Career Quest are intended to enhance both the career preparation of all students and the appeal of vocational offerings at DVC. By the 1993-1994 school year, the partnership had introduced six changes that can affect students from their middle school years through their college program:

1. Implementation of seventh- and eighth-grade career exposure curricula, focused around the four career cluster options available at the high school level
2. Implementation of a required course on keyboarding, computers, and work readiness for all 9th graders
3. A requirement for all 10th-graders to take at least one of several available "cluster" courses exposing them to occupations in specific career areas
4. Introduction of applied academics in the high schools
5. Improvements in vocational curricula to ensure greater use of computers and current technology
6. Articulation of most occupational courses offered at DVC and the high schools

The details and significance of these changes are discussed next under three broad topics: (1) articulation and programs of study; (2) curriculum and instructional changes; and (3) the guidance process. The final section discusses the governance of the consortium and its resources.

A. ARTICULATION AND PROGRAMS OF STUDY

Efforts to improve vocational education through articulation agreements preceded the first Tech-Prep grant to Dothan and have been incorporated into the Career Quest plan. The district hoped that promoting vocational education as a form of College Prep--through the earning of college credit during high school--would raise the status of occupational courses and stem declining enrollments at DVC. By school year 1993-1994, agreements were signed for the business courses offered at the high schools and for three-quarters of the 20 DVC vocational courses, which range from cosmetology to engineering technology.

The Dothan consortium's articulation agreements specify equivalencies between secondary and postsecondary courses and conditions under which high school students can earn college credit. Under virtually all of the agreements, a minimum grade of B is necessary for the high school level course to qualify for college credit. A grade of A guarantees that credit will be awarded, while a B grade usually requires a student to take a "challenge test," developed jointly by DVC and college instructors, to demonstrate the relevant competencies. Under the general agreement between Dothan City Schools and Wallace Community College, credit for articulated high school courses is granted when a student who meets these conditions enrolls at the college, and the credit appears on the student's college transcript just as if it had been earned at the college.

Under Career Quest, all students choose a general career direction, but in school year 1993-1994, their choice has limited effect on their high school program after 10th grade. On the basis of their interests and goals, students select one of four broad career clusters at the end of ninth grade: (1) industrial/engineering; (2) business/information systems; (3) health/human services; or (4) arts and communications. This choice determines which one-semester "career cluster course" students take in 10th grade. Further implications of this choice were being defined in fall 1993. The district was working to finalize the identification of science, math, and occupational courses most appropriate for each cluster, so that counselors could direct students to relevant courses. For example, students in the health/human services cluster with an interest in health occupations would be encouraged to take anatomy rather than some other 11th-grade science course. Although all students choose a career cluster, they do not necessarily take vocational courses. However, the district is working with counselors to require students who do not intend to pursue four-year college degrees to take at least one DVC course related to their chosen career cluster.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Four curriculum changes have been made under the Career Quest plan. The district has (1) raised graduation requirements, (2) increased career exploration activities, (3) introduced and implemented applied academics curricula, and (4) enhanced the rigor of selected vocational curricula.

1. Higher Graduation Requirements

As part of the Career Quest reforms, the district adopted a new set of graduation requirements to improve the level of students' academic and technical competencies when they leave high school. Beginning with the freshman class entering in school year 1992-1993, all Dothan students must complete four years of course work in math, English, science, and social studies. Moreover, students who by 11th grade are ineligible to receive an Advanced Diploma--the high school degree required to enter a four-year college degree program in Alabama--are required to pursue an occupational specialty by enrolling in an occupational course at DVC or their home high school related to their chosen career cluster. These new requirements are the culmination of earlier steps taken by the district to raise graduation standards beyond those required by the state department of education. State regulations require students to complete four years of English, but only three years of social studies, two years of math, and two years of science.

2. Increased Career Exploration Activities

Students were provided with increased opportunities for career exploration and work-readiness preparation. The district implemented a new year-long mandatory course for all 9th-graders. This course, which will phase out a two-semester typing elective, teaches basic keyboarding skills, computer literacy, and general employability skills, such as how to behave in a job interview. It also provides a week of computer-based career exploration and interest inventory completion, along with an introduction to Career Quest's four career areas, to help students choose their required 10th-grade career cluster course.[1]

The four one-semester cluster courses, which were taught for the first time in school year 1993-1994, have a common core as well as elements pertaining to each career area. All four courses include units on knowing yourself and exploring career options. Each course also includes material on the occupations that are grouped in the cluster; these units most often involve exercises that expose students to common industry terminology and basic skills. For example, the health/human services cluster course has units on nutrition, disease, and first aid; the industrial/engineering cluster course has units on scales and measuring, sketching, CAD applications, and blueprint reading. The cluster courses are taught by teachers selected by the districts, all of whom have taught some type of related occupational course. These teachers are also responsible for inviting guest speakers into the classroom and developing special projects for students. Students in each cluster course spend some time in newly built career centers at their home high school, completing interest inventories and researching a paper on a career of interest.

Implementation of the cluster courses has involved some scheduling difficulties. The district's new graduation requirements allowed room for few electives in students' schedules, particularly for 10th-graders who were required by the state to enroll in a semester of health and a semester of driver's education. The Dothan partnership, which from the start had full support from the state Department of Education, had to seek waivers from state regulations to replace the health requirement with the cluster course.

Dothan also applied for and received a waiver to reduce instruction in state-funded vocational programs from three to two hours each day and to shorten them from three-year to two-year programs (in 11th and 12th grade), to accommodate the new Career Quest courses and requirements. Still, potential vocational education courses were crowded out of students' schedules because many students choose music or sports as their one elective. In 1993, Dothan submitted a proposal to the state for an additional waiver to change the scheduling plan to a semesterized, eight-block day. Under this plan, students would have only four 96-minute classes each day during a semester. They would choose eight courses each year, with two of the four core academic subjects scheduled each semester. District supervisors believe this schedule will facilitate interdisciplinary and team teaching, because teachers will have one period off each day. The longer periods will also allow time for extended labs and special projects. Most important for Career Quest and Tech-Prep, the new schedule will provide more opportunities for electives, including vocational education.

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[1] Students who are undecided about their choice of career cluster may enroll in two cluster courses--one in each semester of 10th grade.

First-year experience with the newly required 9th- and 10th-grade courses also provided guidance for refining the courses themselves. The curricula for these courses were developed by a team that included district and college administrative staff, teachers, and business and industry representatives. However, once the career cluster courses were under way, district supervisors discovered what they considered unnecessary overlaps in career exploration activities between the cluster courses and regular 10th-grade English. It also became clearer to consortium staff that in order to stimulate interest in career options, they had to vary the class format with videos and guest speakers, and that especially dynamic teachers were needed to present the cluster course curriculum effectively.

3. Introduction of Applied Academic Curricula

The district has adopted applied academics as an instructional approach that would appeal to and improve the success of a potentially wide range of students. Relying on CORD and Agency for Instructional Technology (AIT) course packages, the two comprehensive high schools offer Applied Math I and II, Applied Communications, and Principles of Technology.[2] Although there was initial resistance from some teachers, most of the applied courses have been increasingly well received by students and school staff.

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[2] The district also plans to purchase a curriculum called Chemistry in the Community, developed by the American Chemistry Society.

Implementation of the Applied Communications curriculum, however, raised some concerns. This course, which was available to 12th-grade students in 1993-1994 as "Tech English," was viewed by counselors in at least one high school as suitable primarily for non-college-bound students who were in the work-study program or had particular academic difficulties. English teachers felt that the course lacked adequate study of literature and failed to develop the skills they thought were important. At the same time, they felt the curriculum was not very relevant to the world of work and required instructors to teach material that was outside their realm of expertise. As a result, changes will be made for 1994-1995. Selected modules from the Applied Communications curriculum will be incorporated into English classes for all four high school grades. In 12th grade, the class will be an approximately equal mix of literature and applied communications modules.

Applied academics courses are available to all students, but counselors guide students to them somewhat selectively. By school year 1993-1994, the district was offering nine sections of Applied Math I, two of Applied Math II, six of Principles of Technology, and two of Applied Communications--spread across the two high schools. Counselors generally advised students with weaker skills to take Applied Communications but less often to take Applied Math or Principles of Technology. These latter courses include a broader mix of students--Applied Math because the original teachers could be persuaded to take the class on only if it included some students who had already taken algebra, and Principles of Technology because algebra I or Applied Math II is a prerequisite.

4. Modifications to Occupational Courses

The district and its partners have also modified and added occupational courses offered at both DVC and in the high schools. With the help of the corporate partners, the basic machine shop class at DVC was transformed into a premechanical engineering course, with greater emphasis on computers, robotics, and math. Because of its increased academic rigor, this new year-long engineering technology course was designated an honors course and has drawn many pre-engineering students who in the past would not have been expected to take courses at DVC. The auto mechanics course is slowly being revised to become an automotive technology curriculum; a more up-to-date text has been adopted, more time is being spent learning to use diagnostic computerized instruments and simulators, and less time is spent actually repairing cars. Several business courses, which are taught at the comprehensive high schools, were modified at the urging of the college to prepare students better for skills that would be expected of them in postsecondary classes. For example, the most current versions of word-processing software and up-to-date computer hardware were installed to ensure that students would be prepared for the materials and technical environment they would face at college. The district was also planning to introduce new courses at the high schools to provide some occupation-specific exposure for students in the arts and communications cluster; courses in mass media and video production will be offered for the first time in school year 1994-1995.

C. RECRUITING, GUIDANCE, AND CAREER DEVELOPMENT

Career Quest focuses on districtwide reforms in career development for all students, rather than on creating a distinctly identified Tech-Prep program. In planning and implementing the initiative, the district has incorporated career exploration into the curricula, starting as early as middle school, and has built career centers in both of the high schools to provide better access to information and counseling for students. The same set of activities and opportunities is provided to all students, rather than targeted to students with particular occupational or educational goals.

Despite the broad application of these career development components, there are implicit distinctions made between students who are preparing for four-year college and those who are not. Although students do not make any explicit choice between a College Prep and Tech-Prep program, counselors make such a distinction when students reach 11th grade. They designate Tech-Prep students according to the progress they have made toward achieving an advanced diploma, the high school degree required to enter a four-year college program in Alabama. Students who have taken any general education courses, who have not taken at least two years of a foreign language, or whose math sequence up to that point makes it impossible to take college preparation math by 12th grade will be granted a Standard Diploma. Starting in school year 1994-1995, all such students will be designated for Tech-Prep in the guidance folder maintained by their counselors. These students will be required to enroll in vocational courses at DVC or at their high schools as a way of improving their preparation for work. From students' perspective, however, they will not be in an identified Tech-Prep program or track.

Both Tech-Prep and College Prep students will begin participating in career exposure activities in the seventh grade, under a district plan for career exploration and the development of occupational goals. In seventh and eighth grades, they will take nine-week career development courses based on Maine's PREP curriculum. The courses help students begin to understand their aptitudes and interests, using commercially available interest inventories, videos on the world of work, guest speakers, and special exercises designed to increase their knowledge of potential careers and job attributes. The courses also cover some life and employment skills, such as budgeting, interviewing, and how to look for jobs. During 7th and 8th grade, the courses introduce students to occupations in the four groups highlighted in the 10th-grade cluster courses. Students use the school library to gather information about career areas and then report on them to their class. Starting in school year 1994-1995, middle school students will begin developing "student profile" folders that will move with them to high school. The folders will serve as portfolios; students will be encouraged to accumulate and include the results of their interest and aptitude assessments, documentation of their educational preferences or plans, records of their work experience, and evidence of any special skills or strengths.

In high school, students participate in many of these same career development activities in regular academic classes and the new courses developed as part of Career Quest. Ninth-grade social studies teachers, for example, spend one day discussing how different occupations fit into the four career clusters and the types of personal attributes and interests that are needed for occupations in each cluster. In another class period, students visit the career center and learn how to use the computerized interest and aptitude inventories and other resources. As part of a ninth-grade English assignment, students gather information from the center about a particular career and present an oral report to the class. In the ninth-grade course on keyboarding, computers, and work readiness, students learn more about the computer-based career planning and assessment tools in the career center and the characteristics of occupations in each of the four clusters. The district expects these 9th-grade activities to prepare students to select a career cluster at the end of 10th grade.

Career development activities will continue in grades 10 to 12, with increasing focus on developing educational plans to meet occupational goals. In the 10th-grade cluster courses, introduced in school year 1993-1994, students are expected to review the educational preparation necessary for their careers of interest and to identify postsecondary institutions with strengths in these areas. Cluster teachers are expected to help students develop educational plans for the remaining years of high school and college, including 2 + 2 plans for students intending to enter community or technical colleges. Activities for 11th and 12th grades will be introduced for the first time in school year 1994-1995. In 11th grade, the career center and English classes will expose students to procedures for taking college entrance exams, completing college applications, searching for jobs, picking a college, and getting a scholarship. In 12th grade, students will be required to use the career center three times during the year and to complete a resume as part of an English assignment.[3]

Most of the career exploration and planning activities implemented as part of Career Quest revolve around the career center maintained at each of the high schools. These areas were specially constructed and outfitted as part of Career Quest--at the request of, and to gain the cooperation of, school counselors. District staff considered counselor support for the Career Quest reforms and objectives particularly important, because counselors had historically resisted referring students to DVC and focused more on students planning to attend four-year colleges. The district also sought to ensure counselors' cooperation by including them in the early planning of Career Quest.

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[3] Students will be expected to sign in and out of the career center as documentation of their use of the facility.

Counselors participated in the examination of reform models, the selection of Tech-Prep, and the steering committee formed to review and approve the initiative's design. They also developed the career and educational planning activities that were incorporated into classroom curricula. Initial concern among counselors that the career centers would be underutilized if they were simply "available" to students, rather than the focus of mandatory activities, led to the incorporation of career center activities into course curricula.

D. GOVERNANCE AND RESOURCES

The structure of administration and oversight of Career Quest has changed somewhat since the early planning stage. A Tech-Prep steering committee was formed around fall 1990, to plan the reform effort and to act as a governing board. It was a large group, by design; district staff felt it was necessary to include representatives of almost all school personnel who would be affected. Steering committee members included high-level staff from the college and school district, both high school principals and a middle school principal, one high school and one middle school counselor, department representatives from the core academic areas at the high schools, and the principal and an instructor from DVC. The committee meetings were also often attended by Alabama's state director for vocational education and the state Tech-Prep coordinator; the Dothan partnership was considered the leading Tech-Prep consortium in the state at the time, so it received a great deal of attention. Business representatives initially interested in vocational education improvements were kept informed of the progress of the steering committee by district staff. The steering committee had several subcommittees; for example, separate groups met to finalize articulation agreements in specific fields or to develop curricula for particular cluster courses. The committees met frequently between 1990 and 1992, as articulation agreements and new curricula were developed and approved. In 1993, with most of the new components already planned (if not implemented), the full committee met only twice.

Starting in school year 1994-1995, the governance of Career Quest will be folded into the work of regular district staff. Career Quest is now considered part of the regular districtwide curriculum, so issues relating to the new components are expected to be discussed in the same manner as other secondary-level issues. As a result, the original steering committee has been disbanded and its responsibilities given to the district's new secondary and middle school advisory councils, which will include more representatives from the key groups on the earlier steering committee as well as parents.

From the very start, funds for Career Quest were spent on direct planning and implementation rather than on general administration. In spring 1989, the early partners received a special state grant to plan their reform efforts, even before federal Tech-Prep funding was available. Dothan City Schools then received an $87,500 two-year Title IIIE implementation grant starting in 1991 and another $20,000 in Title IIIE funds for school year 1993-1994. Although a core group of administrators from the district and Wallace Community College prepared most of the planning documents and curricula and coordinated implementation, their role as consortium staff was integrated into their regular job responsibilities and paid for out of normal district and college operating budgets. The partners have instead used their Tech-Prep funds to purchase curriculum packages, prepare lab facilities for applied academic courses, and offer staff development. The consortium also received a special grant from a corporate foundation to fund the development of the two high school career centers.

IV. EAST PEORIA, ILLINOIS

A complex Tech-Prep consortium serves this large, mostly rural area in central Illinois. Illinois Central College in East Peoria and 21 school districts formed the consortium in September 1990. More than 13,000 students are enrolled in Illinois Central College, a two-year school. The 21 school districts, which include 29 high schools, are organized by the state into three regional systems that deliver "education for employment": (1) the Peoria Educational Region for Employment and Career Training; (2) the Tazewell County Area Education for Employment Regional Delivery System: and (3) the Central Illinois Vocational Education Cooperative. These regional systems--which coordinate vocational education in the secondary schools--play an important role in the consortium. Each system has its own Tech-Prep coordinator, who structures and promotes Tech-Prep in member districts, and has a voice in decisions involving these districts and the college.

Implementation of Tech-Prep with students is just beginning. In school year 1993-1994, 19 of the 29 local high schools had decided to participate in Tech-Prep staff training and curriculum development; 2 schools had students actually participating in Tech-Prep classes. This profile draws on initial examination of Tech-Prep development in these two high schools--Illinois Valley Central and Deer Creek-Mackinaw--and at Illinois Central College. The program development progress described here also reflects the strong role in consortium activities played by the area's dominant employer, Caterpillar, Inc. The company employs about 25,000 people in the area and directly or indirectly affects the fortunes of about 60 to 70 percent of all area businesses.

Tech-Prep reforms in central Illinois are closely related to other recent or ongoing local education changes and to state-level guidance on the definition of Tech-Prep. Illinois Valley Central High School introduced "Block 8" scheduling in 1993, shifting from traditional 50-minute class periods to 84-minute periods and reorganizing the school week so that students take each of their classes twice or three times a week rather than every day. This schedule change is particularly suitable for applied academics classes and vocational laboratories, which involve extra time for setup and execution of experiments and hands-on exercises. This school, like some others in the state, has also been taking steps to eliminate the general education track, dropping low-skill classes in math and other subjects and requiring all students to take algebra for two or three semesters. The local conception of Tech-Prep has been very heavily influenced by the program definition adopted at the state level, particularly the requirement that consortia develop, for each occupational cluster, a clear sequence of courses from ninth grade through college, with well-defined multiple exit points for students who want to pursue only a one-year vocational certificate, an associate's degree, or a four-year degree.

Although the Illinois Central consortium is making changes that other consortia have "packaged" as a Tech-Prep program, the consortium has placed little emphasis so far on creating a distinctive program identified as Tech-Prep that students explicitly choose to enter. Instead, the consortium has implemented components associated with Tech-Prep in a way that may affect a wide range of students. The salient features of the development efforts so far are:

- ***Articulation and Programs of Study.*** Systematic commitments on general secondary/postsecondary cooperation, course articulation, and formulation of sequences of courses relating to broad technology clusters spanning high school and college, with multiple exit points

- ***Curriculum and Instruction.*** The introduction of applied academics curricula as part of these programs of study, and the development of project-based activities linking efforts of students in vocational and academic classes

- ***Recruiting and Guidance.*** A marketing approach that publicizes opportunities for postsecondary study and rewarding careers available through articulated technical programs to all students, rather than emphasizing a choice that students must make between Tech-Prep and College-Prep

These three topics are discussed next, followed by a brief description of consortium governance and resources.

A. ARTICULATION AND PROGRAMS OF STUDY

The Illinois Central College consortium has concentrated on creating three building blocks for pathway programs linking high school and college. General agreements on cooperation have been established between participating high schools and the college. Specific programs of study--course sequences identifying classes to be taken at the high school and college level--are defined for five occupational clusters. Articulation agreements identifying particular high school courses that can earn college credit are negotiated.

The foundation for linking high school and college programs is high school and college administrators' commitment to a standard "Tech-Prep agreement." The terms of this agreement were formulated by the directors of the three regional employment education systems and the community college, and are being used as a model for general agreements statewide. Agreements based on this model were signed in spring 1993 by each of the 21 school districts, committing them to:

- Identify a school-based team of academic and occupational teachers, a counselor, and an administrator to work on curriculum development
- Hold school meetings at least monthly to ensure continued progress on changes related to Tech-Prep
- Send a team member to an annual Illinois "Tech-Prep Connections" conference to learn about approaches to integrating academic and vocational education
- Send school Tech-Prep team members to an Illinois conference on Tech-Prep in fall 1994, and to Tech-Prep training for academic and vocational teachers during the school year
- Work with the community college to develop and implement an articulated Tech-Prep curriculum

Much of the consortium's attention has focused on developing programs of study that spell out sequences of recommended courses in grades 9 to 12 and in college for a wide range of occupational programs. Course sequences have so far been developed for 23 existing college programs in five broad career areas: (1) information systems; (2) manufacturing technology and computer-assisted design; (3) electronics; (4) agricultural technology; and (5) engine power technology. Students preparing to enter the 11th grade choose courses within one of these five broad areas. Each area branches into a more specialized program at the college level, differentiated by the degree and focus of specialization, the credential attained, and the extent of postsecondary study required. For example, a manufacturing technology student after high school could choose among programs that culminate in a one-year certificate in welding, an associate's degree in welding technology, or a four-year bachelor of science degree in manufacturing technology (after articulation to a university program is completed). The program sequences for these related degrees are the same at the high school level, but they diverge at the college level.

Programs of study specify recommended academic and vocational courses at the high school level for these five career clusters. They also identify which of the 23 college-level programs they can lead into. For example, high school manufacturing technology students are expected to take four years of English, four years of math (Applied Math I and II, geometry, and algebra II), Applied Biology/Chemistry, and Principles of Technology.[1] From the high school occupational offerings, they are expected to take, during the four years of high school, two semesters of mechanical drawing and an introduction to drafting and computer-assisted design (CAD), metals technology, four semesters of manufacturing technology, and more advanced drafting and CAD courses. At the postsecondary level, the manufacturing technology program branches into five associate's degree programs: (1) mechanical design technology; (2) robotics/automated manufacturing technology; (3) manufacturing technology; (4) numerical control technology; and (5) welding technology. Illinois Central College has begun negotiations with Bradley University, Illinois State University, Southern Illinois University, and Western Illinois University to articulate its associate of science (A.S.) degree programs with their baccalaureate degree programs.

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[1] Academic course requirements vary across the five broad occupational areas. For example, the electronics area requires more advanced mathematics than some of the other areas.

Articulation agreements on granting college credits for high school courses have been greatly extended during the years since the first Tech-Prep grant was received. Representatives of the three regional delivery systems have negotiated articulation agreements with Illinois Central College on behalf of the 21 school districts, which adopt the agreements for courses they offer, subject to verification by the college that their high school course curriculum is closely aligned to the articulated college course. Agreements have been signed for 11 specific occupational courses--shorthand, speedwriting, typing, welding, mechanical drafting, architectural drafting, engine power, accounting, machine trades, numerical control, and word processing.

Obtaining college credit for high school courses requires that students take an initiative, but they may not yet clearly perceive the opportunities for earning college credit. Students must have received no less than a B in the high school course, and credit can be granted only after the student has earned a grade of at least a C in a college advanced level course for which the articulated course was a prerequisite. The college does not automatically award credit to students who fulfill these requirements. Students must apply for the credit no later than 24 months after they graduate from high school, and must complete a credit request form, approved by the high school principal and the college dean of career education, for each course. Perhaps because 1993-1994 was the first year of student participation in Tech-Prep, most of the students who took part in a fall 1993 focus group were unaware that they could earn college credits for their high school work.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Innovation in curriculum and instruction is occurring at both the secondary and postsecondary levels in the Illinois Central College consortium, although in varying degrees. At the secondary level, academic requirements are being raised in some schools, applied academics curricula are being introduced, and cross-curricular projects are being used to create opportunities for contextual learning. At the college level, some technical courses are being revised, existing applied courses are being enhanced, and interdisciplinary technical projects are being used to help students integrate academic and technical concepts and to build partnerships with high schools. New curriculum development is guided by a competency list developed at Illinois Valley Central High School, as well as a 1993 survey of local employers, the SCANS report, and other sources. This overall effort identified 17 broadly defined competencies, such as effective oral and written communication skills, decision-making skills, and self-management skills.

Academic requirements are being raised as part of the definition of programs of study, but not consistently across consortium schools. In general, the programs of study require four years of English, four years of math, two years of science, two years of social science, and four years of physical education, in addition to the prescribed sequence of occupational courses. However, not all schools in the consortium have instituted the same requirements; for example, Deer Creek-Mackinaw High School, in fall 1993, still required only a minimum of two years of math and one of science for students in occupational programs. Schools that are increasing requirements are also introducing course-duration flexibility to help all students get through more than the most basic math courses; for example, schools offer both the basic algebra course and geometry in two-semester and three-semester sequences.

Applied approaches to academic instruction are being introduced at the high school level, both in newly developed courses and in adjustments to existing academic instruction. A wide range of commercially available applied curricula have been purchased by the consortium and are already in use in at least some consortium schools, including Applied Math, Applied Communications, Applied Biology/Chemistry, Principles of Technology, Biological Science Applications in Agriculture, and Physical Science Applications in Agriculture. Some science teachers, even those who are using more traditional curricula, report that they are adopting teaching approaches or lab exercises suggested in these applied curricula. The selection of applied academic curricula has been left up to individual high schools.

Throughout the consortium, schools are emphasizing the use of schoolwide cross-curricular projects that draw on the skills of students from various academic and occupational classes. In some cases projects give students opportunities to integrate and apply what they learn in different disciplines. In school year 1993-1994, for example, El Paso High School conducted a kitchen remodeling project. Home economics students suggested the remodeling they thought necessary for their classroom kitchen. Various classes were then involved in particular phases of the work--drafting students to design it, the CAD class to prepare final drawings, the business class to solicit bids for materials, the speech class to argue the need for the project before the school board, a foreign language class to make the same presentation in another language, building trades students to carry out the construction, and an English class to publicize the project through press releases and newspaper articles. Illinois Valley Central High School has prepared a handbook describing more than over 150 cross-curricular projects involving at least two teachers and subject areas; these projects involved a total of 44 teachers. For a project on soil erosion, for example, English classes maintained a journal of the project, geography students created maps and models, and science students ran tests to identify soil types. Some projects give participating students a chance to combine what they learn in different classes. For example, in one project led by a child development instructor and a Spanish teacher, high school students learned techniques of working with small children in teaching Spanish songs.

At Illinois Central College, some steps are being taken to update technical curricula. College faculty, working in cooperation with teachers from several high schools, developed a revised, more advanced electronics course to avoid redundancy with the Principles of Technology course and with the upgraded texts and experiments used in the high school electronics courses. Some faculty have begun to revise existing courses in technical math, technical communications, and technical physics to introduce more applied learning opportunities. Some instructors, however, in areas that lead to special certificates with requirements are defined by industry groups, are reluctant to revise their curricula, out of concern that they might deviate from certification requirements.

Supported by Tech-Prep funding, Illinois Central College has initiated creative efforts to integrate academic and vocational learning. The college has prepared a *Methods of Integration* booklet, for dissemination to other colleges, illustrating 11 examples of strategies, methods, and projects already in place for integrating technical and academic learning. The booklet highlights, for example, the college's electronics technology mathematics course, which is designed to show students the direct application of mathematical concepts in electronics, from linear equations and basic trigonometry in the first year through differential and integral calculus in the second year. The booklet also documents projects at the college that involve students in hands-on work integrating scientific, mathematical, and technical material. For example, in a gasoline to electric vehicle conversion project, students converted a donated sports car, replacing its gasoline engine with an electric motor and storage batteries. The system was designed, fabricated, and tested by college students in their technology lab, drawing on what they had learned in physics, math, mechanical design, manufacturing/CAD, and electronics classes.

Projects such as these can help build partnerships between schools and industry. In the vehicle conversion project, for example, the car was taken to consortium schools, where students in vocational programs could perform experiments and analyses on it. Students designed improvements to the vehicle and wrote reports, service manuals, and press releases about it. An industry advisory committee was formed to provide technical oversight for the project.

C. RECRUITMENT, GUIDANCE, AND CAREER DEVELOPMENT

At the early stage of Tech-Prep implementation observed in fall 1993, the consortium was putting far less emphasis on attracting students to a clearly identified program than on expanding articulation, defining course sequences for occupational clusters, providing teachers with practical exposure to industry, introducing applied learning methods, and developing cross-curricular projects. As a result, Tech-Prep reforms have the potential to affect a wide segment of students, but it is difficult to identify a "Tech-Prep student." Consortium leaders have consciously defined Tech-Prep not as a separate track to be chosen by students, but as something that can be available to and affect all students.

Consortium and school staff have downplayed a distinct Tech-Prep Program, but they do publicize the changes that are under way. School posters, the most visible publicity directed to students, emphasize a "future that works" but do not draw attention to the term "Tech-Prep," which is printed in small letters at the bottom. Information about Tech-Prep is distributed to parents and students in various forms such as flyers and bulletin board displays. Each high school develops its own description for its Tech-Prep handbook. These materials emphasize that Tech-Prep can lead to four-year college, a message intended to counter concerns that it might block chances for higher education.

As a result, it was difficult in fall 1993 to gauge students' reactions to Tech-Prep reforms and their awareness of the secondary-postsecondary career pathways that Tech-Prep is intended to create. The consortium schools do not systematically ask students to elect Tech-Prep as a program, and each school can define for itself the criteria for reporting the number of students involved in or affected by Tech-Prep. Focus groups with 11th-grade students at the participating high schools were made up of students taking an occupational course included in one of the defined Tech-Prep programs of study. These students, when asked about the significance of Tech-Prep, described some of the reforms under way in their schools--new ways of teaching, more applications of academic material to occupations, more teamwork in class, cooperative learning, and an increase in computer work. They understood less about program sequence, acknowledging only that Tech-Prep was "something about their future," and were generally unaware of options for earning college credit in high school. Student awareness could be expected, of course, to be somewhat sketchy in the first years of program implementation, particularly among 11th-graders who are only midway through their high school careers as the reforms are being phased in.

Work exploration is a possible future component of Tech-Prep in the Illinois Central College consortium. It could conceivably build on the existing paid cooperative work experience program, but some obstacles would have to be overcome. For example, at Illinois Valley Central High School, the work experience program, although it has grown recently and places about 25 students a year, includes only a few students who are in a program of study defined as Tech-Prep. According to the half-time program coordinator, the introduction of Block 8 scheduling, although an improvement for lab-based classes, makes co-op placement difficult because the occupational classes that students would miss by going to work are no longer regularly scheduled each afternoon but, instead, occur only a few days a week. However, the Illinois Valley Central superintendent believes that an expanded work exploration program, including students bound for four-year colleges who want to explore professional careers, would be valuable.

D. GOVERNANCE AND RESOURCES

The Tech-Prep consortium is led by a governing board and supported by a consortium staff and coordinators serving parts of the consortium. The board is composed of the Dean of Career Education at Illinois Central College and the directors of the three Education for Employment systems. The staff includes a part-time Tech-Prep coordinator and a part-time workforce preparation coordinator at the college. These staff provide overall program coordination, staff training, liaison to employers, marketing materials, and other services. In each of the Education for Employment systems, a part-time coordinator serves as liaison to the member school districts, to develop articulation agreements and coordinate staff training.

Tech-Prep teams at each of the 19 actively participating high schools and at the college have been essential for the planning and implementation of Tech-Prep. Each school's team is made up of an administrator, a guidance counselor, and teachers of math, English, science, and vocational/technical subjects. Each team has developed a local school mission, goals and objectives for Tech-Prep, and an action plan that specifies (1) how the team plans to integrate curricula, (2) how applied academic curricula will be implemented, and (3) what cross-curricular projects will be developed.

The consortium is supported by an active advisory council, composed of local business and industry representatives. During the first several years of the Tech-Prep initiative, this council helped supervise an assessment of the employability and technical skills desired by employers, hosted tours for students, and participated in panel discussions on Tech-Prep planning. Council members have presented information to high school students and their parents, donated testing equipment to high schools, and hosted academic teachers for week-long practicum placements at Caterpillar, Inc., Methodist Medical Center, and the State Conservation Department, to help students see how skills are applied in the workplace.

The Illinois Central consortium is combining funds from both federal and state sources to carry out its planning and implementation activities. In school year 1992-1993, the consortium received a Title IIIE Tech-Prep grant of $115,000 and a state Tech-Prep grant of $58,000. About three-quarters of these funds were used for staff development, curriculum development, and lab equipment and materials. The remainder went primarily to general administration. In addition, the consortium has received state funding from the Vocational Instruction Practicum program; in combination with Tech-Prep funds, these resources have been used for the short-term placements of high school and community college academic teachers at worksites.

V. FRESNO, CALIFORNIA

The State Center Tech-Prep Consortium, centered in Fresno, spans a geographically large area and includes many school districts serving very diverse populations. The Tech-Prep consortium structure built on an existing collaboration to develop articulation agreements, but its membership expanded somewhat after the consortium adopted Tech-Prep as a framework for major reform in 1992. By fall 1993, the consortium had grown to include all schools that had signed an articulation agreement with the State Center Community College District (SCCCD)--a total of 29 schools from 19 local districts--as well as two Regional Occupational Program (ROP) offices.[1] The members of the community college district are Fresno City College, with 18,000 students, and Kings River Community College, which serves 6,000 students in a rural community 25 miles away. Many of the districts are small and rural, located almost 30 miles from Fresno. The districts' student populations range from about 3,000 in Kerman and 5,000 in Sanger Unified to more than 75,000 in Fresno Unified, the third largest district in the state. In Fresno, almost 40 percent of the population--and up to 70 percent in some schools--is Latino. Furthermore, this proportion is expected to grow. Almost half of all students in the Fresno district come from families that receive welfare payments. In contrast, the 22,000 students in Clovis Unified District are predominantly white and come from families that, for the most part, expect their children to attend four-year colleges.

In such a large and diverse setting, developing a consistent Tech-Prep program model is very unlikely. Great differences in the populations, resources, and needs of the participating communities, as well as the distances between school districts, make it difficult for the consortium to develop or promote a single Tech-Prep model. Individual districts and even schools within districts have their own idea of what Tech-Prep is and how it should be implemented. Given this diversity, it is not possible to describe briefly the direction of Tech-Prep development throughout the consortium; exploration of the member districts' diverse approaches will require further visits. This initial profile focuses on the dimensions of diversity observed, drawing in particular on the approaches to Tech-Prep found in the two largest secondary districts--Fresno and Clovis--and in Sanger, one of the smallest.

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[1] The ROP is a state-funded vocational education delivery system that trains youths and adults for entry-level employment. Vocational programs funded by ROP must be based on labor market needs, and training may be provided at high schools, adult centers, or other sites.

The economy of the large area served by the Tech-Prep consortium poses some challenges to educators interested in preparing youths to enter high-skill occupations. The unemployment rate is 14 percent in the city of Fresno and higher in the more rural communities. Agriculture is still the predominant industry, although some employment growth is anticipated in Fresno's developing manufacturing sector and in health occupations. Most employment in the area is in small businesses.

The consortium's Tech-Prep initiative follows almost a decade of collaboration between SCCCD and surrounding school districts on articulation. In the mid-1980s, the state of California and SCCCD promoted articulation, or 2 + 2, as a way to increase community college enrollment and help students avoid redundant course work. In 1985, the new chancellor of SCCCD made articulation the centerpiece of his five-year plan for the colleges. The district received a small state grant in 1986 to support development of articulation agreements, as well as additional larger grants in each of the next two years. SCCCD worked on articulation with five school districts at first, got expressions of interest from more, and developed a standard process for course articulation agreements. Although the focus of articulation activities was on vocational courses, SCCCD also began to encourage the articulation of academic courses.

These efforts resulted in a large degree of articulation. By the end of the third year of state funding in 1989, SCCD college presidents and superintendents of about 10 local school districts had signed more than 130 articulation agreements. As interest spread to other schools and districts in the SCCCD service area and articulation of academic courses began, more than 150 additional agreements were signed between 1989 and summer 1992, when SCCCD received its first Title IIIE grant and held the first formal Tech-Prep steering committee meeting.[2] The college district also pursued a collaboration with California State University/Fresno (CSUF) that would allow students to earn credit for some high school courses, whether they matriculated directly to CSUF or transferred after completing an associate's degree at one of the SCCCD campuses. This collaboration, unusual at the time, was widely promoted by SCCCD as its 2 + 2 + 2 initiative.

As a whole, consortium staff view Tech-Prep as a process, not a program. Their efforts are directed at stimulating educational reforms that will benefit all students in the consortium schools. The consortium has refrained from attempting to formulate a particular model involving a defined set of courses or activities. However, consortium leaders have developed "vision statements" and other materials that identify what all members consider key components of a Tech-Prep strategy. These components include articulation, integration of academic and occupational curricula, applied learning, and the development of course sequences for career preparation. The extent to which individual districts or schools adopt or emphasize these components is expected to vary, and schools have in fact pursued different reforms. Some are content with 2 + 2 articulation, some favor academic interdisciplinary teaching rather than an emphasis on technical preparation or career-oriented course sequences, some view the introduction of applied academics as the major or sole activity, and some are developing career academies.

A. ARTICULATION AND PROGRAMS OF STUDY

Articulation of courses is the cornerstone of the Fresno Tech-Prep initiative so far. It is the only component of the Tech-Prep strategy that has been widely adopted and implemented; most of the districts and schools in SCCCD's service area have developed at least some articulation agreements with the colleges. Most of these agreements were reached before the advent of Tech-Prep funding, but efforts continue to expand agreements to include additional occupational and academic courses in many schools.

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[2] The number of college courses involved, however, was much smaller, because SCCCD counts articulation with each course in each high school as a separate agreement. For example, forestry courses in Sierra High School and Duncan Polytechnical High School, linked to the same introductory forestry course at the colleges, count as two agreements.

The consortium has established a standard articulation process that can be initiated by either district or college personnel. Most often, secondary teachers obtain and complete a "Request for Articulation" form from their district, and the district submits it to the college. The relevant college department head arranges a meeting with district staff and the teacher to compare the district and college courses in question. The district may be required to make changes to its course curriculum to align it satisfactorily with the college course. Each agreement, which must be approved by the college curriculum committee, is supposed to be reviewed by the school and the college informally each year and formally every three years. In practice, however, it appears that high school and college faculty have only informal and limited contact after agreements are signed.

The conditions under which students receive articulated credit are intended to encourage them to pursue degree programs at SCCCD. To receive credits for a high school vocational course, students must earn a grade of C or better in that course, complete 12 college credits, and maintain at least a 2.0 college grade point average in the courses in which they earn these 12 credits.[3]

However, students so far rarely take advantage of the potential benefits of articulation, largely because they lack information or encouragement to do so. Among students who are eligible to receive advanced credit (those who have received a grade of C or better in the high school course), many, particularly those enrolled in business programs, retake the introductory, articulated course at the college level rather than enter a more advanced course. Consortium staff and high school administrators believe that use of articulation is low because teachers do not encourage students to seek credit. Many teachers do not consider a C grade in their articulated high school course equivalent to the same grade in a college course. The teachers are reluctant to encourage students to skip over entry-level college courses, for fear that students will be unsuccessful and their own teaching competence will be questioned. Some teachers have suggested raising the minimum credit-granting grade to a B or using competency exams to confirm students' skills. However, consortium staff have argued that the articulation process equates the college and high school courses; because C is an acceptable passing grade at SCCCD, it should also be acceptable for granting advance credit.

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[3] Articulation to CSUF lacks these incentives. Although students must earn a B or better in the high school course to receive credit at CSUF, there are no other minimum requirements for the awarding of credit, at least for vocational courses.

Consortium staff have recognized the low use of articulation agreements and are beginning to think about ways to address this issue. One complicating factor is that students who earn an associate of arts (A.A.) degree at SCCCD usually graduate with more than the required number of credits. This suggests that students may be insensitive to the monetary or time costs of earning credits beyond the minimum requirement and thus may not respond to the "time-shortening" advantages of articulation.

Consortium staff are interested in going beyond simple articulation of courses to develop articulated *sequences of courses*, or career pathways, that define courses from 11th grade through the community college. Some preliminary efforts were under way by school year 1993-1994. The Tech-Prep steering committee had drafted a description of the process for developing Tech-Prep pathways; the process includes labor market studies to select target career areas, education and industry input to develop competency lists for each specialized program within a broad pathway, and modification or creation of secondary or postsecondary courses as necessary.

Fresno Unified and Sanger Unified districts, both chosen by SCCCD as pilot sites for Tech-Prep, have adopted plans for career pathways or clusters. In fall 1993, Fresno district staff had just begun to identify the vocational courses that would be appropriate for five broad career clusters: (1) agricultural technologies; (2) business technologies; (3) consumer and family studies technology; (4) health technologies; and (5) industrial technology. Three of Fresno's six high schools were beginning to implement at least one career pathway each, which students generally would enter in ninth grade. The Fresno district has an ambitious goal: to have career clusters in place in all schools by about 1998, with specialized strands within each cluster that will link more directly with college programs, and potentially to have all students choose a cluster to guide their course selection.[4] The district's commitment to this goal is underscored by its dedication of all Perkins funding to Tech-Prep planning and implementation. Sanger, a much smaller district, was working enthusiastically on planning pathway sequences for secondary and postsecondary courses in automotive technology and agriculture. It expected to implement Principles of Technology labs and cross-curricular teams in school year 1994-1995. Few, if any, other districts were taking specific steps in fall 1993 to implement career pathways.

School districts in the State Center Tech-Prep Consortium face some of the same challenges as other consortia to implementation of career pathways. First, students have few slots in their schedules for vocational courses or other career-specific electives. In 1984, the state increased academic requirements for a high school diploma, narrowing students' options for vocational courses or other electives. Around the same time, Fresno Unified shortened the school day from seven to six periods, further limiting opportunities for electives. As a result, most students are unable to fit vocational courses into their schedules until their senior year in high school. Second, the small rural schools do not have the resources necessary to offer students much more than the basic academic curriculum required by state regulations. They have limited vocational offerings and are in many cases too isolated to bus students to larger schools for vocational courses.[5] The small rural schools also find it difficult to release teachers for staff development activities, because each teacher performs multiple school functions, and it is not always possible to find substitute teachers. Finally, cutbacks in community college funding have resulted in overcrowding and waiting lists for some programs--

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[4] District staff acknowledge, however, the likelihood that smaller schools will be unable to offer specialized strands because of limited resources and vocational offerings.

[5] Moreover, courses funded by the state's ROP must be staffed by credentialed instructors, and recruiting such teachers is difficult for small rural districts. Although vocational courses funded by districts do not require specially credentialed teachers, most small districts cannot commit the required resources for a sustained period.

particularly SCCCD's health programs--that will make it difficult for students to complete their chosen pathway. Fresno Unified administrators intend to seek special priority in college program admission for Tech-Prep students, but the outcome of that quest is uncertain.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Consortium staff emphasize curriculum integration as a key component of Tech-Prep, but integration is broadly defined and interpreted in diverse ways. In some schools, efforts focus on transforming academic curricula by increasing relevance to the world of work and creating opportunities for active learning--a strategy adopted in the applied academics curricula available from the Center for Occupational Research and Development (CORD) and the Agency for Instructional Technology (AIT). Other schools view integration as a process of linking specific academic subjects with specific occupational courses. Still others emphasize interdisciplinary instruction that coordinates teaching of several academic subjects around common themes. These approaches were being tried in different schools during the 1993-1994 school year, with varying degrees of success.

The Chancellor's Office of California Community Colleges and SCCCD have been actively promoting the use of CORD and AIT applied academic curricula for all California Tech-Prep consortia and for all State Center Tech-Prep Consortium schools. At the request of the Chancellor's Office, SCCCD holds the state license for CORD materials and is responsible for coordinating related teacher training and curriculum dissemination. SCCCD established guidelines to ensure that consortia take teacher training seriously and use it effectively. SCCD sends curriculum materials to consortia only after the directors and teachers attend an orientation session. In order for staff to attend training sessions, the consortium administrator has to agree that the team to be trained will include two secondary teachers and one postsecondary instructor. During summer 1993, SCCCD conducted one-week training sessions for more than 400 teachers from around the state. Despite the training requirements, SCCCD followup a few months later--in the first year of CORD course implementation in California--indicated that few were actually teaching the courses for which they had been trained.

Implementation of CORD courses was limited, it appears, by teachers' resistance to replacing their entire courses with the packaged curricula. Although teachers generally endorsed contextual learning, relatively few felt that the CORD curricula alone fully met the teachers' instructional and content needs. Consortium staff also believe that some teachers are reluctant to identify certain courses as "applied," out of concern that the courses will be viewed as appropriate for only certain groups of students, thus creating a distinct program track.

To accommodate these concerns, the consortium is promoting universal adoption of an applied approach to all academic classes and the use of CORD materials as curriculum supplements rather than as a core curriculum. As a result, applied instruction can be implemented in any manner or not at all in the consortium schools, at the option of local district or school staff. School administrators and consortium staff agree that the effects of promoting applied academics are often difficult to identify in some classrooms. However, the new California frameworks in math, science, and language arts are encouraging applied approaches to academic subjects. Over time, this effort may lead to wider interest in and adoption of applied curricula and methods of instruction.

The consortium has also promoted interdisciplinary teaching and projects and supported them with staff development opportunities. In several consortium high schools, teams of teachers have been formed that span academic subjects and sometimes include a vocational area. These interdisciplinary teams intend to develop a curriculum for each subject area that is linked to the other subjects represented on the team. In Clovis West High School, for example, a team developed a cross-disciplinary project for school year 1993-1994, in which a small number of students used class time in each subject area to develop a joint proposal to address overcrowding at Yosemite National Park. The team included instructors of math, English, science, and automotive technology. The team teachers have also worked to integrate CORD materials and approaches into traditional math, science, and English classes to some extent. Scheduling difficulties caused first-year curriculum integration efforts to fall short of the ideal, however. The first group of students identified to work with a teacher team--those enrolled in the automotive course--were not clustered together in the academic courses using the new curricula. The team at Clovis West agreed that block scheduling of courses and clustering of students are vital to the team's effectiveness.

The consortium has also sponsored other activities to promote interdisciplinary instruction. For example, the consortium scheduled an "automotive in-service day," in which consortium staff, college auto faculty, all ROP auto instructors, other vocational instructors of automotive technology, and state auto repair licensing officials worked on developing competencies and course materials that would help students meet certification and licensing standards. The staff who attended also worked on ways to integrate the vocational curriculum with academics. At Duncan Polytechnical High School in Fresno--a vocational high school--the building trades and air-conditioning courses were redesigned to incorporate modules from CORD's Principles of Technology course; some modules are team taught by the vocational and academic instructors.

To a limited extent, applied curricula have been introduced at the postsecondary level as well. CORD applied academics materials have been adopted to varying degrees by SCCCD faculty. Some faculty have incorporated CORD's Applied Math I into their college developmental-level classes. It should be noted that the same curriculum is being used in grades 9 through 11 in several of the other consortia discussed in this report.

Articulation efforts have led to some shifts in vocational-technical courses in the consortium schools. Most often, aligning secondary and postsecondary courses has produced changes in high school rather than college courses. Fresno Unified administrators report that some vocational courses have been upgraded as a result of this process. The modifications made by various high schools to ensure that their course teaches the same competencies covered in the first-semester college course to which it is articulated have resulted in greater standardization in vocational curricula across consortium schools. A positive outcome of this process, according to one college instructor, is that students from different schools are more likely to have learned similar material when they reach the advanced technical course at the college. As a result, the college instructor's course preparation and instruction can be more focused.

C. RECRUITING, GUIDANCE, AND CAREER DEVELOPMENT

Because the State Center consortium is promoting Tech-Prep as a diverse menu of reforms rather than a program track, there were no identifiable Tech-Prep students in fall 1993. The consortium's goal is to bring about reforms to enhance the education of most or all students, rather than to create a program for a select group. As a result, neither the consortium nor individual member schools define certain students as "Tech-Prep." At state request, SCCCD is preparing Tech-Prep marketing materials for statewide use, but so far these materials have not played a central role in local implementation, because the consortium has not emphasized recruiting specific students or marketing an identified Tech-Prep program to students or parents. In a few schools, however, specific career pathways have been defined and promoted, and students have been enrolled in these course sequences.

Consortium staff have emphasized development of career awareness and direction as an objective, but each district and school addresses this objective in its own way. Some new initiatives are being developed: for example, Sanger, Clovis, and Fresno High Schools are introducing a program that links students with businesses. In grades 10 through 12, small groups of students participate in field trips and job shadowing to expose them to different careers, to complete mock job applications, and to develop resumes and portfolios. Volunteers from area firms such as Dow Chemical conduct seminars for students and serve as occasional mentors.

D. GOVERNANCE AND RESOURCES

The State Center Tech-Prep Consortium is led largely by college staff, but a variety of secondary and postsecondary staff are involved in consortium governance and activities. Efforts to define and promote reforms associated with Tech-Prep are conducted through a formal structure of committees and working relationships that was used successfully during the articulation efforts of the late 1980s and early 1990s.

There are two main groups that govern the consortium--a steering committee and a 2 + 2 + 2 coordinating committee. The steering committee, which meets monthly, includes consortium staff, the superintendents and principals of the five districts originally targeted to pilot Tech-Prep, relevant college deans and department chairs, and administrators of the ROP offices. This high-level group was intended to include only individuals who could commit to and carry out policies or decisions agreed to at the meetings; teachers or counselors, who would need approval before implementing any activities, were excluded. Teachers, counselors, and college faculty are, however, included in the coordinating committee. This committee has existed since the early work on articulation began, and its membership has remained fairly stable. The function of this committee seems primarily to keep all of the consortium partners aware of consortium activities and to provide a forum for discussing issues or problems.

The ongoing work of the consortium is entrusted to a staff of about eight. No staff salaries are paid from the consortium's Title IIIE Tech-Prep grant, because the consortium sought to institutionalize Tech-Prep by encouraging partners to commit financially to the consortium's work. Almost all staff members were either college staff or were hired by the college specifically to assist in Tech-Prep implementation. One person who works nearly full-time on Tech-Prep is from the ROP office; another is from the Fresno Unified School District. Salaries of five consortium staff are paid by special grants the consortium received from the state Department of Education and the Chancellor's Office of California Community Colleges. One of these grants involved developing career pathways in the industrial technology area, and the other involved creating outreach and guidance materials for statewide use. Consortium staff produce a newsletter to update members on consortium activities and upcoming events, act as a curriculum clearinghouse, and provide other forms of technical assistance.

Tech-Prep funding, not required to support consortium staff, is instead used to promote staff development. Most of the consortium's $60,000 Title IIIE grant for 1992-1993 was used to pay for release time of secondary and postsecondary personnel to attend staff development sessions, and for outside experts to provide technical assistance and staff training.

Independent of the Tech-Prep steering and coordinating committees, separate advisory committees for occupational programs at the secondary and postsecondary levels have existed for some time. The ROP administrators are trying to strengthen these committees, promoting the idea of having college faculty and secondary teachers form joint advisory committees for occupational programs. ROP is also requiring the committee for each program it funds to maintain a ratio of three business representatives for each teacher, and to hold at least two meetings annually, in an attempt to revitalize these committees and infuse them with an employer perspective.

VI. GAINESVILLE, FLORIDA

The Tech-Prep consortium in Gainesville was formed by Santa Fe Community College (SFCC) and the School Board of Alachua County (SBAC) and its eight high schools. Building on a long history of collaboration, the college and the school district established a Tech-Prep liaison committee in 1990, and later applied for and received an initial Title IIIE grant for school year 1991-1992. In school year 1993-1994, the consortium expanded to include neighboring Bradford County, with its one high school and a technical center, a satellite campus of SFCC, and one campus of four-year St. Leo's College.

The economy in which the Gainesville Tech-Prep program is developing can be described as bimodal. On the one hand, the University of Florida--with its 35,000 students and prestigious medical school--and several other hospitals have attracted a substantial upper-income professional population. Incomes for the rest of the area's population, however, are low. About 55 percent of the elementary school population is eligible for free or reduced price lunches; furthermore, a survey in the late 1980s showed that more than 90 percent of all employees in the county earned less than seven dollars per hour. The county boasts four or five large manufacturing firms, employing from about 175 to 1,300 workers, but no new major employers have begun operations in about a decade.

The development of Tech-Prep builds on years of close cooperation between SFCC and the Alachua County Schools. From the late 1960s through 1973, the college and the district used several cooperative arrangements to run vocational programs, including having the college run secondary vocational programs out of a former junior high school at one time. Since 1974--long before the advent of Tech-Prep--the college and the district have offered high school juniors and seniors several options for dual enrollment in the Santa Fe Community College High School Program:

- ***Vocational Dual Enrollment.*** Qualifying high school students can take both their occupational and academic classes at the college, earning credits toward a postsecondary occupational certificate or an Associate of Science (A.S.) degree. In 1992-1993, more than 300 students participated in this, the largest of the dual enrollment programs.

- ***Academic Dual Enrollment.*** Students who have exhausted high school offerings in a particular subject can take a full academic program, including college-level classes at SFCC, or can take some college classes and the remainder of their course work at their home high school. For college-level academic classes, they earn credits toward both a high school diploma and an Associate of Arts (A.A.) degree.

- ***Early College Admit.*** Students who feel unchallenged in high school can take a college placement exam to qualify for enrollment in a full college-level program. Each year, a few students satisfy requirements for an A.S. or A.A. degree at the same time that they are granted a high school diploma.

- ***Fine Arts Dual Enrollment.*** Students in grades 9 to 12 can take SFCC courses in the visual arts, dance, music, and theater, if these course are not available at their high school. Course credits can be applied to an A.A. degree.

This wide range of dual enrollment options facilitates the development of Tech-Prep in several ways. It allows expansion of course options for high school students without duplication; for example, students who are ready for advanced algebra in a high school that does not offer it can take the course at college. Taking courses on a college campus can also build students' maturity and self-esteem, and these students can carry positive information about community college programs back to high school campuses.

Tech-Prep in Gainesville builds on the earlier dual enrollment vocational program in three ways. First, the consortium is systematically developing articulated programs of study covering four years of high school and postsecondary study, each leading to a college certificate or degree in an occupational specialty. Second, applied academics curricula are being developed and introduced in grades 9 to 12, and to some extent at the college level. Third, the career development process--including development of individual programs of study, career awareness and career-focused curricula, and workplace exposure--has become more systematic. These changes are being driven by an elaborate Tech-Prep governance and planning structure.

A. ARTICULATION AND PROGRAMS OF STUDY

The salient feature of the emerging Tech-Prep program in Gainesville is the implementation of a comprehensive form of secondary/postsecondary articulation. Since 1974, the dual enrollment programs operated under an articulation agreement that specified the responsibilities of SBAC and SFCC, the basis on which they shared costs and revenues from dual enrollment programs, and the manner in which credits earned in SFCC courses would be calculated as high school credits.[1] The new Tech-Prep articulation agreement incorporates and extends the terms of the earlier one. It defines four key aspects of Tech-Prep for students who choose Tech-Prep over the University Prep program:

1. A planned sequence of high school and college courses leading to either an occupational certificate or an A.S. degree
2. Completion in high school of upper-level math, English, and science/technology courses taught using applied curricula and instruction methods
3. Expanded opportunities to participate in dual enrollment programs and to earn college credits in high school
4. Programs of study focusing on technical preparation in high-skill areas in a wide range of career fields

These key features mark the shift from course articulation to articulation of programs. Each of the roughly 35 programs of study developed to date sets out a student's full academic and vocational program for grades 9 to 12 and for community college, with the exception of one elective each semester. Furthermore, many programs of study recommend appropriate electives, as well as co-op work placement. Each program of study identifies the college-level programs, and the courses in these programs, for which credit can be earned in a specific sequence of high school vocational courses. For example, a student who completes three years of progressively more advanced drafting and design technology classes in high school can earn credit for a four-term college sequence. Most college credit earned is based on the vocational component of the students' high school program, but college credit in mathematics can also be awarded to students who take college-level intermediate or advanced algebra in high school. College credits are awarded, however, only if a student completes the entire secondary portion of the program of study, including both vocational and academic classes.

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[1] Dual enrollment programs offer financial advantages because the college earns some state aid for each college-level course taken by high school students, while SBAC earns full-time state aid for dually enrolled students, even though they may be taking most or even all of their courses at the college.

Programs of study are grouped in broad clusters, but students choose an occupational specialty. For purposes of organizing planning committees and structuring marketing materials, the consortium has defined nine broad career clusters: (1) business and marketing; (2) computer science; (3) technical education; (4) industrial technology; (5) electronic engineering technology; (6) health occupations; (7) environmental science; (8) agritechnology; and (9) human services. When students begin Tech-Prep in ninth grade, however, they choose a particular occupational specialty within one of these clusters. For example, within the computer science group, students can choose computer programming analysis, computer information systems analysis and applications, or business data processing. In industrial technology, they can choose automotive technology, automotive service technology, industrial machinery maintenance and repair, or residential construction and building technology. The choice of a program of study for a particular occupational specialty--identified by the postsecondary program in which it culminates--gives students a clearly defined path of required study leading to a postsecondary credential. Choices of a specific occupational program made in ninth grade can be reexamined later; the similarities among requirements for related specialties allow students considerable latitude to change their minds during the first few years of high school, without extending the overall time required to reach their degree objective.

Although about 35 articulated programs of study have been defined, students' choices are somewhat narrower in practice. Each high school chooses which programs to offer, on the basis of the school's strengths in its existing vocational programs, as well as the interests and eagerness of academic and vocational teachers to get involved. High school offerings are also partially determined by district decisions to create certain magnet programs--such as an Institute of Health Professions (IHP) at one high school and an environmental horticulture program at another. Most students currently choose from among the existing vocational programs for which articulated programs of study have been developed--between 4 and 8 programs at each of six high schools, but 11 at one high school and 16 at the SFCC high school.[2] Some students, however, can choose a program offered at another school and can ride a school bus to attend the program.

Given the many options built into programs of study in Gainesville, the consortium's Tech-Prep model can be characterized as "4 + almost anything." Some programs lead to an A.S. degree, which generally requires 64 college credit hours, or more than two years of full-time study. Others lead to an occupational certificate after one or two years of college. Some programs have multiple exit points. For example, a student can complete the high school portion of some health programs and exit with a marketable skill as a phlebotomist, go on to the community college for one semester and get a certificate as a paramedic, attend college a full two years and get an A.S. degree in emergency medical services, and then pursue a baccalaureate degree in health administration through St. Leo's College. Under Florida's uniform course numbering system for state colleges and universities, students can readily transfer academic credits from community colleges to four-year state institutions. SFCC is negotiating with several colleges and universities to allow graduates of occupational technology programs to transfer credit into other bachelor's degree programs.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Every program of study emphasizes exposing students to higher-level academic material than was typical in the general and vocational education tracks. Students choosing any of the articulated occupational programs of study must take the following in high school:

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[2] Secondary vocational programs in Florida must demonstrate positive employment outcomes to receive continued funding. If, for three years in a row, they cannot demonstrate that 70 percent of program graduates become employed in a related field, state funding may be terminated. The consortium relies on this overall policy to ensure that the articulated programs it offers prepare students for demand occupations.

- Four years of math (compared with the three-year state requirement)
- Four years of English, including two of applied communications
- Three or four years of science, typically including Principles of Technology and biotechnology (Applied Biochemistry). In less science-oriented fields, such as business administration or fashion marketing technology, three years are required. In more technical fields, students may be required to take general science, two years of applied science/technology, and a college-level science course at SFCC in 12th grade--such as anatomy and physiology, circuit fabrication, or herbaceous plants.

Changing the academic classes taken by Tech-Prep students has been a gradual process. Committees representing the college, high schools, business, and the community had to be formed to develop or adopt curricula (see Section D). Teachers interested in applied curricula and innovative approaches to instruction, such as hands-on, self-directed inquiry and cooperative learning, had to be recruited. Teachers had to be trained, and labs had to be equipped. The process is not yet complete, nor does it affect only Tech-Prep students. Although applied academic curricula are being introduced as part of Tech-Prep, some students who are not technically enrolled in Tech-Prep, such as vocational students in programs not yet articulated with the college, also take such classes. Students in 11th and 12th grades who were enrolled in articulated occupational programs in the 1993-1994 school year were taking applied academics classes but not necessarily in all three target subjects. Moreover, as the "start-up group," they had not taken applied classes in 9th and 10th grades.

Although the fall 1993 site visit did not clarify the precise extent to which revised academic classes are available in each school, clear examples of applied academics instruction were observed:

- In an Applied Math class for 11th-graders, students practiced estimating the perimeter of a large building. They first established the number of paces and the number of seconds required to walk 100 feet--working in small teams and walking the distance several times to establish average rates. They then walked the perimeter and measured it in paces and seconds, applying computed rates to estimate the total distance.
- In a biotechnology class (based on a commercially available Applied Biochemistry curriculum), students entered the lab and immediately went to work in pairs on an exercise designed to demonstrate the relative effectiveness of various compounds in extracting water vapor from air. The instructor circulated among them, answering questions and giving occasional advice.

- In an Applied Communications class made up largely of students who were also enrolled in an automotive technology program, the instructor asked students to define a new automotive product and develop an outline for a commercial to advertise it. Students sat in small groups, struggling for reasonable ideas and words to express them. Students in Applied Communications classes work part of the time in a computer-equipped writing lab, in which teachers stress the ability to write very short but technically correct memoranda--emphasizing complete sentences, sentence structure, punctuation, and spelling.

Instructional approaches used in applied academics classes, such as cooperative learning, to some extent affect teachers of other classes that Tech-Prep students might take. For example, some students in a Tech-Prep articulated program were observed in an English IV class that was not based on an applied academics curriculum, but rather stressed reading of classical literature. The students had read a portion of *Macbeth*; working cooperatively in small groups, each with an appointed recording secretary, they were developing lists of Duncan's characteristics and the basis for their judgments, reporting their conclusions and justifications to the whole class.

Although curriculum enhancement to date has concentrated on academic rather than vocational classes, and on the secondary rather than the postsecondary level, there are exceptions. In developing articulated programs of study, curriculum committees work to align the technical content to be covered in high school and college courses. In the process, changes have been made in some secondary vocational classes, such as the adoption of a college-level textbook on drafting and design. Concepts of applied academic instruction have also begun to affect some college-level classes; the college math instructor who teaches Applied Math to high school students has also developed a college-level course using applied methods and exercises relevant to automotive technology, building construction, and other occupational fields.

Through the IHP at Gainesville High School, movement toward forming career academies has also occurred. Students from Gainesville High or other high schools who choose any of the health-related programs of study attend this magnet program for their academic classes, which are taught by a team of eight teachers who work only with IHP students throughout all four years of high school. Faculty report a great improvement in their own morale and in students' effort and responsibility. Teachers note that, in assessing student performance, they have begun to stress not only academic skills but also personal habits that are important to employers. These habits include willingness to volunteer and participate in group efforts, ability to cooperate and avoid conflict, and attendance and punctuality. According to teachers, students respond to insistence on such habits. Students reported that they were aware of and appreciated this emphasis on behavior and work habits.

C. RECRUITING, GUIDANCE, AND CAREER DEVELOPMENT

Like many Tech-Prep programs, the Gainesville consortium must overcome a common and long-standing prejudice: that vocational education is for youths who cannot make it in college and who can work effectively only with their hands. Preference for the university is also common among parents. A 1990 survey revealed that two-thirds wanted their children to go to college, and more than half preferred a four-year college. Most who anticipated that their children might go to community college saw it as an inexpensive start on a bachelor's degree. (However, the careers that parents perceived as high status and high paying generally required only an associate's degree.) Attitudes are changing, however, particularly among students, who generally view community college more favorably than do their parents. There remains, however, an almost universal demand among parents and students for high school programs that lead to college, as well as a distrust of traditional vocational programs that might not.

Consortium leaders have therefore carefully framed students' choice at the end of eighth grade as a choice between two college-prep programs. Tech-Prep leads to college-level preparation for technical careers, beginning in the community college and potentially continuing at a four-year institution. University Prep leads directly to four-year programs in the humanities, sciences, or arts.

Students who choose Tech-Prep then select a program of study with the help of a guidance counselor.[3] Counselors have been trained and given a carefully prepared manual that sets out the objectives and advantages of Tech-Prep, as well as the programs of study for each of the dozens of occupational specialties. SBAC and college staff make a concerted effort to market Tech-Prep to students, parents, and the community. Early in the year, consortium staff send a Tech-Prep brochure and letter to eighth-grade students and their parents. College staff make presentations at the middle schools and high schools about college occupational programs that students can enter through Tech-Prep, as well as other dual enrollment options. Guidance counselors make their regular presentations in preparation for individual meetings with each student to develop their high school plan and ninth-grade course selection; these presentations now give equal weight to the Tech-Prep and University Prep options. A promotional campaign--including paid radio and television announcements, talk-show appearances, press releases, a Tech-Prep video, and speeches to civic and business groups--has substantially raised public awareness. According to consortium staff, this heightened awareness is evidenced by the fact that local newspaper articles about education, employment, and factors affecting the future American work force frequently refer to Tech-Prep as an established program.

By fall 1993, some students in all four high school grades had chosen Tech-Prep and had developed programs of study. The first two of these cohorts were still start-up groups; that is, they had developed their programs of study in the 10th or 11th grade, rather than in the 9th grade as called for in the program design, and had taken a less complete sequence of applied academics classes than younger students will. A total of 485 students in 11th and 12th grades were counted as Tech-Prep participants. Including 9th and 10th graders, almost 2,000 high school students had chosen Tech-Prep and were pursuing academic and vocational courses based on a program of study for an articulated program.

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[3] Not all vocational programs are articulated with college programs, so the traditional vocational track also exists.

Although only a few cohorts of students have been recruited thus far for Tech-Prep, the program is still developing, and consortium staff recognize the challenge of attracting a Tech-Prep student body that matches district demographics. The Alachua County Schools' student population as a whole is about 66 percent white, 27 percent African American, and 7 percent Hispanic. Thus far, the Tech-Prep student population is more heavily white; for example, the vocational dual enrollment program at the college, which has the largest concentration of Tech-Prep students among the eight high schools, is 77 percent white, 17 percent African American, and 6 percent Hispanic and other groups. Consortium staff have noted that African Americans are more likely to choose business-related programs rather than more technically oriented programs--perhaps because of persistent concerns about tracking of these students into manual crafts--and that females are overrepresented in health occupations and underrepresented in other technical fields.

Two strategies have been pursued that can contribute to Tech-Prep recruiting in general and to attracting a balanced Tech-Prep population. SFCC has conducted special summer programs to attract females and minority males to technical programs--giving participants brief exposure to various occupational courses and arranging for them to go on field trips to engineering firms and other employment sites and meet with recent SFCC graduates who work in technical fields. The school board is installing technology laboratories in all district middle schools; eighth-graders who choose this elective rotate through about 12 work stations during a semester. At these stations, they work in pairs to perform technological exercises, gather data, and prepare reports on their results. For example, students shape airplane wings and test the lift generated by each in a small wind tunnel. These laboratories are part of a broad strategy to promote wide acceptance of and interest in technical careers, and to develop skills in independent inquiry and teamwork.

Activities designed to expose students to the workplace are also part of a broad strategy to promote career focus. The most systematically planned activity is the IHP workplace component. Every IHP student is placed in a volunteer job at a hospital, clinic, or other health facility for 2 to

3 hours per week, or about 75 hours per year. Students are matched with workplaces that they can reach on their own; in some cases, schools provide transportation. Beginning in 1994-1995, SBAC staff anticipate placing 9th- and 10th-grade students in these limited volunteer roles, and placing 11th- and 12th-graders in more intensive rotations at various hospital departments, for unpaid, practical workplace training. For the general student population, SBAC offers an annual career shadowing day for juniors and seniors that has attracted as many as 600 participants.

D. GOVERNANCE AND RESOURCES

A five-level governance structure has been developed to guide the development of Tech-Prep in Alachua County. The ***liaison committee***, which meets once a year, is composed of senior administrators from both the college and SBAC, the Tech-Prep coordinator (from the college staff), and the SBAC supervisor of vocational programs. A large ***leadership advisory committee***, which meets twice a year, includes numerous representatives of all key groups--college and school district administrators, faculty and counselors from the college and the high schools, employers, civic groups, and community residents. Membership for this committee is large, to allow formation of ***curriculum review, evaluation, community awareness, and counseling subcommittees*** that also include representatives from the same key groups. The first two subcommittees include smaller working groups--the former for review of new curricula in math, science, and English, and the latter for functions such as communications with parents, development of business partnerships, and creation of Tech-Prep marketing materials.

The final two governance bodies develop programs of study. ***Curriculum development committees*** have been formed for each of the nine occupational specialty clusters. In turn, these committees have ***occupational subcommittees***, which develop a program of study for each occupational program and submit it for review by the higher-level committees. This complex structure has one noteworthy strength: at all levels, all parties are represented, including the college and the schools, academic and vocational faculty and counselors, and employers and community and parent mentors. After defining programs of study and the courses they include, the curriculum development committees continue to meet, somewhat less frequently, to develop more detailed curriculum materials and teaching strategies. Committee members--high school and college vocational and academic instructors--often conduct mutual classroom observations to enhance their understanding of each other's teaching methods and course content and to refine teaching strategies.

The college's Tech-Prep coordinator and the SBAC's supervisor of vocational programs play lead roles in this complex governance structure. The Tech-Prep coordinator administers the consortium funds (in 1992-1993, a $200,000 Title IIIE grant and $50,000 in local funding). Title IIIE funds were used primarily for the consortium coordinator and part-time clerical staff as well as for staff training, curriculum development, and equipment purchases for applied academics laboratories. Other Perkins Act funds have been used to provide staff training on integration of vocational and academic instruction. A Perkins Act sex-equity grant supported a summer program at the college to attract females to technical programs involving brief exposure to several technical fields. JTPA funds supported a similar summer program for minority males. A state grant has helped finance IHP development.

VII. HARTFORD, CONNECTICUT

Soon after the passage of the 1990 Perkins Amendments, the Capital Region Tech-Prep Consortium was developed as a joint initiative by Capital Community-Technical College (CCTC), the Hartford Public School district (which includes three high schools), and a vocational high school serving the greater Hartford area. The state Department of Education designated the college as the consortium's fiscal agent for Title IIIE grants, and the consortium received its first grant in early 1992. In 1993, the college expanded its Tech-Prep partnership to include four suburban districts (each with one secondary school), using the Tech-Prep model developed with the Hartford Public Schools as a basis for this expansion. This profile, however, focuses on the collaboration between the college and the Hartford school district.

Efforts to develop a Tech-Prep program in Hartford are unfolding against a backdrop of considerable change and, in some respects, turmoil in the participating educational institutions and in the local economy. The college partner, CCTC, is still going through organizational changes associated with the merger of Greater Hartford Community College and Hartford State Technical College that created CCTC. For several years, the Hartford school district has experienced severe financial difficulties, resulting in budget cuts, threats of massive teacher and administration layoffs, and the highly publicized possibility that the district will contract with a private firm to run the schools. Although the greater Hartford area has long been home to some important large employers, including several hospitals, Pratt and Whitney and United Technologies plants, and national insurance company headquarters, many have substantially reduced their labor force. By 1993, Pratt and Whitney's technical training staff, for example, had declined to 4 from 45 a few years earlier.

Formation of the Tech-Prep consortium was the first substantive attempt at collaboration between CCTC and the Hartford district. Although an agreement articulating the vocational child care course at one Hartford high school had been developed about three years before the consortium was established, this agreement was negotiated by individual faculty and was not part of a broader articulation effort. Moreover, few students were taking advantage of the opportunity to earn college credit in high school. Still, the district's vocational division (called the Career Readiness Unit) viewed this early agreement as a foundation for discussions with the college about articulation in other occupational areas.

Further development of course articulation has been the primary thrust of Tech-Prep efforts so far. This effort has involved some curriculum changes at the secondary level. The district has also defined groups of articulated academic and vocational courses at the 11th- and 12th-grade level as Tech-Prep programs of study or "occupational clusters" that are recommended to interested students who apply and meet specified criteria. By fall 1993, the district and the college had defined two such programs in technical fields and were conducting pilot tests of program clusters in two other fields. District staff had also defined course clusters for other fields that may be articulated with other nearby colleges offering relevant programs, even though these colleges are not formally part of the Capital Region Tech-Prep consortium.

A. ARTICULATION AND PROGRAMS OF STUDY

The Hartford consortium's efforts through 1993 were dominated by the development of articulated "clusters"--groups of academic and vocational high school courses for which students can earn college credit. By fall 1993, Hartford Public Schools and CCTC had defined clusters for two high-priority areas: (1) manufacturing technology; and (2) health occupations. Students in all three high schools began to take cluster courses in these two areas in fall 1992 and 1993, respectively. Secondary cluster courses had also been identified for three other fields: (1) child care; (2) law enforcement; and (3) culinary arts. Each high school chose whether to implement one or more of these clusters and to enroll students in cluster courses in fall 1993 on a pilot basis.

Each cluster definition includes particular courses in the 11th and 12th grades. The clusters comprise vocational, English, and science courses in the 11th grade, and the relevant vocational course and a math course in 12th grade. In the 1993-1994 school year, the cluster recommendations for specific academic courses differed. During that year, the clusters for health occupations and child care included English composition and black/urban literature in 11th grade, whereas the manufacturing technology, law enforcement, and culinary arts clusters included Applied Communications. Variations in recommended English courses reflected CCTC staff's view that different postsecondary programs required different competencies. Because the district's objective was to articulate all cluster courses, it accepted the college's preference, although district staff would have preferred to include Applied Communications as the core 11th-grade English course for all clusters.[1]

These cluster definitions are quite nonprescriptive. District staff view these clusters as recommendations rather than requirements, so the actual effect on courses taken by Tech-Prep participants in each program area can vary. Students must take the identified vocational course, because it defines the cluster. However, district staff expect that students will take a variety of English and science courses in 11th grade and various math classes in 12th grade, depending on their ability and past performance, rather than only the recommended cluster courses.

The identified Tech-Prep clusters focus exclusively on high school courses, although successful students can earn college credit in them and move on to postsecondary programs. The cluster definitions include recommended academic and vocational courses only at the secondary level. However, the articulation agreements for courses in each cluster establish the conditions under which students can earn CCTC credit for high school work. Only students who earn a grade of C or better in an articulated high school course can receive college credit for the course and skip over the equivalent entry-level college course. Credit can be granted not only for vocational courses, but also for the recommended English, science, and math courses, including those that use applied curricula.

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[1] The college and district eventually agreed to recommend Applied Communications as the 11th-grade English course for all Tech-Prep clusters.

The Hartford Public Schools district has extended its efforts to develop and articulate occupational clusters to postsecondary institutions other than CCTC. CCTC lacked a postsecondary program in culinary arts, and its resistance to pursuing a business cluster without grant funding for a college-level coordinator stalled district efforts to develop articulation with the CCTC business courses. The school district explored the possibility of articulating these program areas with other nearby colleges. Agreement was slowed by several factors. For example, existing waiting lists for postsecondary program slots and special preconditions for developing articulation agreements imposed by one college led the district to pursue other partners.[2] Despite such obstacles, the school district reached agreements during the 1993-1994 school year with another local two-year college to articulate business cluster and culinary arts cluster courses that would apply to all three high schools. Students were expected to begin taking recommended cluster courses in fall 1994.

Developing students' sense of Tech-Prep as a clear program of study rather than just an articulated vocational course has been difficult for two reasons: (1) school staff's skepticism or reservations about Tech-Prep; and (2) course scheduling problems. Neither high school students nor counselors consistently view the recommended academic courses as a fundamental part of Tech-Prep. In one high school, for example, Principles of Technology has been made available, but counselors scheduled some Tech-Prep students into other physics courses, including more advanced College-Prep classes. They did so because they were unsure of the new course's merits and believed the more traditional courses would be more suitable for students and would better preserve their options for going to a four-year college. The resulting low enrollment in Principles of Technology forced cancellation of the class that year. Other counselors, concerned that the Tech-Prep articulated academic courses would be too difficult, scheduled students into lower-track classes. High school administrators have not always put priority on adjusting the master schedule to facilitate Tech-Prep students' enrollment in the required cluster courses; many participating students have been unable to take the defined sequence.

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[2] For example, the college insisted that the vocational instructor in each high school enroll in and complete the full college course that would be articulated with the high school course.

As of fall 1993, little priority had been placed on grouping students together for the classes recommended in their chosen cluster, or for integrating academic and vocational course curricula within each cluster. For the manufacturing technology cluster, a team of teachers developed special modules for Applied Communications relevant to manufacturing; most of the schools tried to group students in this cluster for at least this one academic class. However, for the most part, Tech-Prep students were not consistently grouped by program area in their academic classes. English classes included students in both child care and health occupations; students in child care, culinary arts, and law enforcement were taking the same Principles of Technology classes (called "Applied Physics"). Despite some plans for teaming teachers in cluster courses, cost constraints and class scheduling difficulties prevented these arrangements. As of fall 1993, there was little contact between academic and vocational teachers, and thus little effort to link academic classes to students' vocational curriculum.

B. CHANGES IN CURRICULUM AND INSTRUCTION

By fall 1993, the Hartford consortium was pursuing two objectives in its curriculum and instructional changes. First, efforts were being made to introduce a more applied curriculum in academic courses for Tech-Prep students to increase their motivation and interest in science and English classes. Second, in developing the cluster definitions and course articulation, the consortium was introducing some academic classes with greater academic challenges and higher standards.

Applied academic curricula have been introduced for most of the clusters defined by the district, in classes open only to Tech-Prep students. The defined clusters for manufacturing technology, child care, culinary arts, and law enforcement include Applied Physics. This course, which is based largely on the Center for Occupational Research and Development (CORD) Principles of Technology curriculum, is taught in a specially built laboratory in each of the three high schools. The clusters for manufacturing technology, law enforcement, and culinary arts also include Applied Communications, a combination of the English course taken by most 11th-grade students and some modules from the Applied Communications package from the Agency for Instructional Technology (AIT). The health occupations cluster--known as the health academy--does not recommend any applied academic courses. This pattern of recommendations for applied academic courses in fall 1993, however, was expected to evolve by the next year; starting in school year 1994-1995, all Tech-Prep clusters would recommend Applied Communications as the 11th-grade English course. For applied academic courses included in cluster definitions, the district provided some guidelines on course structure, but individual teachers can modify and emphasize different curriculum components. As a result, the extent to which classes incorporate applied approaches or are relevant to particular occupations varies considerably.

To a limited extent, the process of defining occupational clusters introduced expectations that some students would take more rigorous courses. Tech-Prep students are urged to take a college-level math class in 12th grade, although this course is not currently articulated. CCTC and the school district defined this honors math class to combine trigonometry, algebra II, and precalculus material, as well as some physics applications. Students would have to complete algebra I and geometry, with a grade of C+ or better, to enroll in the course. CCTC and a consortium business partner, United Technologies, strongly recommended offering this course to 12th-graders. The course was expected to become available in school year 1994-1995, when the first full cohort of Tech-Prep students reached 12th grade.[3] The number of schools at which the course would actually be offered, however, was expected to depend on the number of students eligible to take it and on whether counselors referred enough students to satisfy the 15-student minimum required in each school.

Existing high school vocational courses are also being upgraded to align them with the college courses to which they are articulated, although some changes have encountered difficulties. An intensive two-year health occupations program was adopted in all three schools, emphasizing skill development rather than brief exposure to careers; this program supplements the one-semester introduction to health careers course, which is now geared more toward sophomores. The second year of the health occupations vocational component is now designed to focus on job shadowing and internships at medical facilities.[4] A traditional metalworking/machining class was upgraded into a manufacturing technology course, with the intention of focusing on processes rather than machines, relying more heavily on computers, and providing greater integration with communications and math skills. In fall 1993, however, delays in equipment delivery were limiting this transition. In the health and manufacturing clusters, vocational courses were to be based on the textbooks used by CCTC faculty teaching similar courses. Use of these texts was a precondition for articulation, but first-year experience indicates that the Tech-Prep students selected so far may lack the strong reading skills and reading habits these texts demand.

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[3] A small pilot cohort of Tech-Prep students in manufacturing technology reached 12th grade in fall 1993, but the college math class was not yet offered.

C. RECRUITING, GUIDANCE, AND CAREER DEVELOPMENT

The approach to selecting participants in the defined Tech-Prep clusters reflects some divergence of priorities between the school district and CCTC. The college argued strongly that students should be carefully selected on the basis of fairly stringent criteria to maximize their chances of succeeding in the articulated cluster courses and more advanced college courses. Although district staff initially agreed to high entrance standards, they had some concerns that these standards might discourage students from applying and might limit Tech-Prep participation. The formal application for Tech-Prep funds submitted by the consortium reflected the college's viewpoint, specifying that students selected to start in the clusters as 11th-graders must:

- Have at least a C average through 10th grade
- Have no more than 10 unexcused absences during the past semester

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[4] The first group of Tech-Prep students in the health occupations cluster reached 12th grade in fall 1994. In fall 1993, these internships were still being planned.

- Be willing to attend after-school and summer programs for additional lab exercises and workplace experiences
- Be willing to sign and have a parent sign a contract committing to the program
- Submit two letters of recommendation from teachers or counselors
- Complete an interview with a team of Tech-Prep counselors and teachers to demonstrate interest in and readiness for the program

Adherence to these admission standards was uneven as of fall 1993. Because students must be admitted to Tech-Prep in order to enroll in the cluster vocational course, high schools were under some pressure to accept any students who expressed an interest in one of the Tech-Prep vocational courses, whether or not the students met all of the Tech-Prep program criteria. This flexibility has raised concerns among college staff about whether Tech-Prep students will be ready for the demands of a college program, and whether there will be substantial attrition before they reach the college level. The college's concern appeared warranted by some limited high school results: in the first marking period during fall 1993, only 54 percent of students in the health occupations cluster across the three high schools were earning a grade of C or better--the minimum that will be required to receive college credit under the articulation agreement.[5] District staff reported that more than 60 percent of the students had achieved the minimum grade by the end of the second marking period.

These concerns in the first few years of Tech-Prep implementation may also be due in part to a recruiting approach that reflects the school district's flexible vision of Tech-Prep rather than a clear emphasis on it as a demanding, high-standards program. To stimulate students' interest, high school counselors make brief presentations during sophomore home room periods and use hall posters, newsletters, career days, and one-on-one counseling sessions to spread the word. Despite efforts to promote the Tech-Prep clusters as career preparation, students' motives for entering the programs are quite mixed, according to staff. Counselors report that some students are attracted to Tech-Prep by the idea of earning college credit in high school; others are interested in learning skills (child care, technology, cooking, legal terminology) that might be useful in their everyday lives. Relatively few students, according to counselors, appear to choose a Tech-Prep cluster as a way of preparing for a career.

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[5] Attrition from the program may occur for reasons other than poor performance. In all three schools, there was attrition between the first and second year of the manufacturing technology program among students who expected a high-technology course with a well-equipped laboratory, but found that delays in equipment delivery left them in what was still largely a traditional metalworking and machining workshop.

Any effort to characterize enrollment in Hartford's Tech-Prep clusters is reduced to a count of students enrolled in the vocational courses that are included in the Tech-Prep cluster definitions. Because of the difficulties described earlier in scheduling students into the cluster academic classes, students are counted as "in Tech-Prep" if they take the cluster vocational course, even if they are not taking the suggested academic courses. In one high school, 1993-1994 enrollment included 20 students in law enforcement, 12 in health occupations, 11 in child care, and 12 in the first year of manufacturing technology and 5 in the second year. Each of the other two high schools had a total of between 30 and 50 students in Tech-Prep. Overall, Tech-Prep enrollment is likely to increase, however, with the implementation of the business and culinary arts cluster starting in school year 1994-1995. The students enrolled in Tech-Prep reflect the racial/ethnic distribution of the city schools--primarily African American, Latino, and other minority students, with fewer than 10 percent white students.

Although students' focus on careers may not always be central to their choice of Tech-Prep clusters, consortium staff are trying to develop workplace experiences that can foster greater career direction. The manufacturing technology program offered internships, sponsored by Pratt and Whitney, to interested Tech-Prep students between grades 11 and 12 in summer 1993. Students were paid more than $6 per hour for six weeks to work at a nearby facility where they learned about safety procedures, measurement, and machine operations. Pratt and Whitney's continued sponsorship of the internship is uncertain, however, given its own financial constraints. District and college staff were planning to focus the 12th-grade segment of the health occupations program around job shadowing and internships at local medical facilities. However, hospitals and other potential employers on the health academy steering committee had not, as of fall 1993, been responsive to consortium requests to commit to internship positions.

D. GOVERNANCE AND RESOURCES

In the early years of Tech-Prep in the Hartford area, governance has gradually evolved from a somewhat fragmented process toward a more unified consortiumwide structure for guiding implementation. At the start, relatively independent committees guided the development of various Tech-Prep cluster programs, largely because of the way that the state of Connecticut funded local consortia. Both secondary and postsecondary partners have, however, been seeking ways to consolidate and coordinate all Tech-Prep development efforts.

The use of state funding by occupational program contributed to some extent to the fragmentation of governance. Through school year 1993-1994, the Connecticut Department of Education awarded Title IIIE funding to local consortia for development of specific Tech-Prep program areas that met what the state considered a Perkins Act requirement: a clear emphasis on technology. In Hartford, Title IIIE funds were thus made available for the manufacturing technology and health occupations programs, but not for the child care, law enforcement, and culinary arts programs, despite the fact that the public school district had formulated and set out to articulate all these programs to postsecondary ones. The college, as fiscal agent, considered the two programs funded by Title IIIE grants to be the primary focus of its Tech-Prep collaboration with the Hartford Public Schools. Although CCTC staff have worked with the district to some extent to develop articulation agreements for the nonfunded cluster cases, as of fall 1993, CCTC had concentrated its efforts on the occupational clusters for which its staff were specifically funded.

Largely because of this program-focused approach to funding and Tech-Prep development, CCTC, the Hartford district, and the suburban districts had no strong incentive in the first few years to form a single consortium governance structure that would coordinate the activities of relevant college and secondary staff. Instead, four different groups played a part, as of fall 1993, in planning or guiding Tech-Prep development: (1) a committee for the manufacturing technology cluster; (2) a committee for the health academy; (3) district and college staff who met on an ad hoc basis to negotiate the terms of articulation; and (4) committees of district and high school staff representing all of the defined clusters.

A separate committee existed in fall 1993 to oversee development of the manufacturing technology program, as part of a statewide initiative, rather than specifically to facilitate the joint efforts of CCTC and the Hartford district. This engineering technologies steering committee was established in 1992 by the three community colleges working on Tech-Prep programs in this technical area: (1) Capital; (2) Three Rivers; and (3) Manchester Community-Technical Colleges. In addition to representatives from the three colleges, the committee included representatives from employers such as Pratt and Whitney and from the state departments of education and labor. Hartford Public Schools also had administrative representation on this committee, but teachers, counselors, and school-level administrators did not participate.

A health academy committee that reflects more complete representation of consortium members was also established. It includes CCTC staff, secondary staff from Hartford and the suburban districts, and health industry employers, particularly from two hospitals. The college's Tech-Prep coordinator for the health academy facilitates these meetings, which began in spring 1993. Unlike the engineering technologies committee, this body includes not only the college and all of the consortium school districts, but also line staff as well as administrators.

Although oversight committees were formed for each of the two funded programs, most articulation arrangements have been worked out by groups of faculty from CCTC and the Hartford schools, temporarily brought together to outline agreements. These groups have worked only on articulation; after the agreements were reached, the members had very little contact. This has resulted in a lack of continuity that has frustrated high school vocational teachers, who generally want more interaction with their postsecondary counterparts, including team-teaching opportunities.

The Hartford district's Career Readiness Unit has created its own committees to coordinate Tech-Prep at the district level, including development of clusters for which the college did not receive Title IIIE funds. The district's steering committee includes teachers from each relevant vocational area, math and science teachers, regular counselors, career technical specialists, and district office staff. Coordinators from the college are invited to attend but do so infrequently. In addition, the district planned in fall 1993 to form committees in each school to develop approaches to Tech-Prep promotion and recruitment.

Changes in governance are being made to create a more unified structure than these four different committees currently reflect. For the 1994-1995 school year, the state plans to award grants to consortia for their overall development efforts rather than for specific occupational programs. This change is consistent with the long-standing interest among Hartford district staff to broaden their working relationship with CCTC and create a more comprehensive governance structure. A consortiumwide committee is being planned that will include college personnel and staff from all five member districts.

The resources available to the Hartford consortium have been used primarily to support Tech-Prep coordinators at the college. The consortium received a $76,300 Title IIIE grant for school year 1992-1993 and about $130,000 for the following year. These grants funded one full-time staff position to oversee the consortium's health academy, another person working about three-quarters time to coordinate the manufacturing technology cluster program, and a modest amount of clerical time. A corporate donation of $25,000 in school year 1992-1993 was used to fund staff development activities.

VIII. LOGAN, WEST VIRGINIA

The Tech-Prep consortium based in Logan, West Virginia, was formed in fall 1990 by administrators at the two campuses of Southern West Virginia Community College (SWVCC) and the Logan and Mingo county vocational schools. These individuals also served at the start as the consortium's steering committee. Early development of the Tech-Prep concept involved the two county vocational schools, three comprehensive high schools and five junior high schools in the two county school systems, and a four-year state college. In 1992, the consortium expanded to include three more junior high schools. Five businesses and two trade associations have also been active enough in supporting and contributing to development of Tech-Prep to be considered members of the consortium.

In the Logan and Mingo economies, the dominance of coal mining and high unemployment divide the nonfarm work force of about 30,000 into three strata. The mining industry, which employs 20 to 30 percent of the work force in the two counties, pays well; people who have jobs in coal mining are generally in the upper-income stratum. Other sectors of the economy offer less attractive wages and account for a middle stratum. The unemployed form a substantial low-income group; unemployment rates were 14 percent in Logan County in 1992 and 11 percent in Mingo County. As a result of this wage and employment pattern, overall per capita income in the two counties is roughly comparable to the statewide average, but per capita income for the employed is among the highest in the state.

Dramatic changes in coal mining technology have played a large part in stimulating interest in educational reform in Logan and Mingo counties. Coal has been mined there for more than 100 years. The region's coal is of exceptionally clean-burning quality, so demand for it is expected to increase sharply as clean air laws come into force around the world. However, extracting the coal at reasonable cost requires increasingly sophisticated technology, and thus more highly skilled technical workers, in mining operations as well as in a variety of related fields that support the mining industry. Local education, however, has not kept pace with labor force needs. As an example of the consequences, one employer described how he had to fly a manufacturer's representative in from New Jersey, at a cost of $9,000, to make an adjustment of less than 1/200,000 of an inch in a machine at his plant. According to local industry leaders, the shortage of well-trained technicians and the challenge of overcoming this shortage have appeared rather suddenly. Local mining technology, which lagged behind world standards for decades, underwent rapid modernization in the late 1980s and early 1990s and now uses the most advanced technology in the industry. As a result, the region's schools must make a major leap forward in technology education if the demand for technically skilled workers is to be met and jobs are to be provided for the local population--particularly because recruiting highly trained workers to the area is difficult.

Interest in and support for the concept of Tech-Prep represents a new start on problems that have recently gained prominence among local educators and employers. In earlier years, without the impetus of the Tech-Prep model and Title IIIE funding, movement toward the kinds of organizational and programmatic features usually associated with Tech-Prep was minimal. Some existing articulation agreements provided for transfer of credit from high school vocational programs to the community college in business, auto mechanics, construction trades, and drafting, and some informal cooperation occurred between secondary and postsecondary instructors. However, there was little ongoing collaboration between employers and the educational system. Furthermore, the educational system devoted no resources to acquisition or development of more applied curricula or instructional methods in academic subjects. High school students had no systematically developed workplace learning opportunities, and schools had no focused emphasis on upgrading the educational preparation of students who were not bound for baccalaureate college programs.

A. ARTICULATION AND PROGRAMS OF STUDY

The SWVCC consortium's early approach to development of Tech-Prep was heavily influenced by state-level decisions to promote high-standard programs through a competitive grant process. The state decided that, in the early years of Tech-Prep development, it would fund only one local consortium for any particular occupational area, awarding grants only to the consortium submitting the strongest proposal in each field. Each funded consortium would then serve as a pilot site to guide implementation of its initial technical program in other parts of the state.

Faced with this competitive challenge, local coordinators focused carefully on choosing a high-demand, high-technology occupational field, rather than simply building on existing vocational programs. They surveyed the entire Chamber of Commerce membership in Logan and Mingo counties to identify occupations in which employers had the greatest unmet labor force needs, determine associated salary ranges, and project future hiring needs. This assessment led the consortium leaders to focus the proposal for initial Tech-Prep funding on electronics and electrical engineering--an occupational field for which no program existed in the consortium at either the high school or community college level. At first, the school and college partners envisioned a program that would focus on a handful of specialties within the field of electronics but, instead, business and industry representatives argued successfully instead for a program that would give students a broad foundation in electronics and allow local employers to train graduates for particular specialties. The resulting proposal outlining a three-year plan to implement this program was first funded by the state for school year 1991-1992. In a similar second-round assessment in fall 1993, consortium leaders concluded that the next occupational specialty program should be developed for environmental technicians in water quality and waste water management--also a field in which no programs existed at the secondary or postsecondary level. This program application was accepted by the state, and implementation will begin in school year 1994-1995.

At least in its occupational focus, the SWVCC consortium found an opportunity to design, implement, and promote Tech-Prep as a new program distinct from the existing general education, vocational, or College Prep programs. The program will include new applied academics and technical courses at both the high school and college level. Because of this focus on occupational fields new to both the high schools and the community college, Tech-Prep leaders had no need to develop articulation, unlike many other consortia that emphasize articulation agreements to reduce course redundancy and provide opportunities for high school students to earn college credit. Students in SWVCC consortium will not earn college credit for participating in Tech-Prep programs in high school (at least for the technical programs planned to date). Instead, college-level courses are being designed to build on the curriculum developed for the high schools, taking students to the highest possible skill levels in each field.

Students who qualify for and choose to enter each of the Tech-Prep programs will follow a highly defined program of study through four years of high school and a community college program. The program identifies applied academic courses, a core of introductory technology courses, and specialized occupational courses. The electronics/engineering sequence, for example, includes the following requirements (in addition to other academic classes required by the state):[1]

- ***Applied Academics:*** Applied Math I and II in 9th grade, Principles of Technology in 11th and 12th grades, and Applied Communications in 12th grade
- ***Introduction to Technology:*** Keyboarding skills and computer applications in 9th or 10th grade, and a technology education course in 9th grade, designed to increase students' awareness of the role of technology in business, industry, and society at large. These courses were developed and implemented shortly before the Tech-Prep initiative began.
- ***Technical Specialty Courses:*** In 11th grade, electronics (fundamentals of direct current and overview of electronics) and general technology I (computer applications, computer-assisted design, and programmable logic controllers). In 12th grade, advanced electricity (oscilloscopes, safety, high voltage alternating current, taping and splicing, and motors

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[1] The curriculum for the water quality and waste water management program will be the same as that for electronics technicians in the 9th and 10th grades. Applied chemistry will be added in the 11th grade, and a distinct sequence of occupationally specialized technical courses will be included for 11th and 12th grades.

and generator controllers) and introductions to graphic arts and the technology of various trades, such as welding, machine tools, and heating and air conditioning.

The community college stage of Tech-Prep includes academic requirements set by the local consortium, general state standards for all community college students, technical course requirements, and workplace internships. Students are required to take:

- Four semesters of mathematics (including college algebra, technical calculus, plane trigonometry, and statistics)
- Two semesters of English, communications, or technical writing; two semesters of physics, one semester of economics, and one semester of humanities
- Twelve technical courses over five semesters (including electrical circuits and machines, microprocessor design and applications, technical and environmental studies, digital electronics, opto-electronics and analog electronics)
- A modified "methods of inquiry" course on study skills
- A three-credit workplace internship during the fall, spring, or summer semester of the second year

The first cohort of students to go through the high school part of the electronics/engineering program will not reach the community college until fall 1995, but the new postsecondary courses are already being taught.[2] The college is already offering a postsecondary degree program to qualified students. As a result, consortium staff expect to be able to refine the new postsecondary courses before the first Tech-Prep high school graduates enroll at the college.

Although the consortium has implemented a 4 + 2 Tech-Prep model, the years before high school and after community college also figure in the overall program design. The guidance component of the program (see Section C) includes assessment and testing in the eighth grade to select appropriate students, as well as ongoing career and course plan reviews through the high school years. For students who wish to go beyond an associate of science degree, SWVCC staff are negotiating with West Virginia Institute of Technology for the community college graduates to go on for a bachelor of science degree in electrical engineering, applying their community college credits toward that four-year program.

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[2] The college offers a summer "bridge" program for students entering its new electrical engineering technology program who have not come through the secondary Tech-Prep sequence. This summer program includes math, English, physics, and drafting.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Implementing the electronics and electrical engineering program has required new academic curricula. Work on these curricula has primarily involved selecting and adapting available curriculum packages--Applied Math I and II, Principles of Technology, and Applied Communications. This work was carried out by the steering committee's curriculum subcommittee--made up of the original four coordinators, relevant department heads from the high schools and the college, and local business representatives. The subcommittee reviewed the math and technology curricula and made minor refinements to add examples and exercises related to electronics. Much more substantial revisions were deemed necessary in the Applied Communications materials, in part to ensure that the course would meet state standards and allow students to earn credit in English toward a high school diploma.

Applied academics classes have been implemented, and staff have been trained to teach them. The consortium encouraged broad participation in training on the use of the new applied academic curricula; workshops were held for instructors and counselors from all the participating junior high schools, high schools, and the college campuses. By fall 1993, Applied Math had been introduced in eight junior high schools, and Applied Math II and Principles of Technology had been introduced in the high schools. The applied classes are in theory open to all students but are required for Tech-Prep students, who are given preference if there is excess demand for these classes. Fitting applied academics classes into school schedules has been difficult in some cases; one principal was concerned that an advanced placement physics class might have to be eliminated for his school to accommodate another class in Principles of Technology.

The vocational courses in electronics for both the high school and college segments of the program were developed cooperatively by instructors from both the secondary and postsecondary institutions, working with the curriculum subcommittee. The instructors reviewed survey input from local employers and available curriculum materials, preparing curriculum outlines for each course.

In addition to developing new academic and vocational courses, the curriculum subcommittee helped modify an existing college course on "methods of inquiry," to introduce more hands-on learning and cooperative learning. The course is designed to help students learn good study habits, as well as how to investigate and synthesize information. During one session of this class in fall 1993, students listened to a 15-minute lecture on proper citation of sources in research papers. They then worked in small groups of three to four, helping one another write citations for various types of sources, such as journal and newspaper articles.

C. RECRUITING, GUIDANCE, AND CAREER DEVELOPMENT

Traditionally negative views about vocational education in Logan and Mingo counties have made it particularly important for consortium staff to promote Tech-Prep as a distinct new program of education for high-tech careers. Parents, students, employers, and school staff have generally viewed vocational education as a track for less-bright, less-capable students. Marketing and publicity efforts have portrayed Tech-Prep as separate from both the existing academic and vocational tracks. These efforts have included an aggressive print and electronic media campaign, special parents' nights to explain Tech-Prep, and television spots by business and industry representatives, project directors, board of education officials, guidance counselors, and faculty.

Although great attention has been paid to building wide interest in Tech-Prep, the implementation plan also calls for selecting Tech-Prep students carefully to maximize their chances of success. Selection occurs in stages during eighth and ninth grades. All eighth graders take a comprehensive assessment battery--the Comprehensive Test of Basic Skills (CTBS), the Career Ability Placement Survey (CAPS), and the Career Occupational Preference System (COPS) Form R.[3]

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[3] The assessment battery used for Tech-Prep was in use in Mingo, but not Logan, County prior to the implementation of the Tech-Prep program. One of the counselors from the Mingo County (continued...)

Counselors discuss test results with students at the end of eighth or beginning of ninth grade and mention Tech-Prep as one possible option. Each student receives a brochure on Tech-Prep, the six-year sequences of courses that can be chosen, the expected benefits of the program, and the selection criteria.

Consortium leaders decided in the initial planning of Tech-Prep that students, in order to be admitted in the 9th grade and then continue on in the program in 10th grade, would have to:

- Achieve a CTBS score in the 35th percentile or above (or be recommended by their English or math teacher)
- Show aptitude and interest for the Tech-Prep associate's degree program on the basis of results from CAPS and COPS
- Earn a C or better in math or English in the eighth or ninth grade (or be recommended by their English or math teacher)
- Complete Applied Math I in the ninth grade

Despite this careful planning, substantial departures from these standards occurred in the first year of implementation. Each middle school was asked in spring 1992 to recruit about 25 interested eighth graders to begin the Tech-Prep electronics sequence in the fall. In general, the five schools succeeded in identifying only 10 to 15 interested students who met the requirements. However, to show responsiveness toward what they perceived as consortium staff's emphasis on recruiting a full cadre of first-year students, schools enlisted additional students who fell short of intended behavioral and academic standards, bringing the total ninth-grade enrollment in fall 1992 up to about 104 students--about nine percent of the overall ninth-grade population.[4] Experience with this first cohort left the ninth-grade instructors somewhat disappointed and prompted renewed attention to selection

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[3](...continued)
Vocational School is taking responsibility for planning and conducting workshops on administering and interpreting COPS and CAPS for all the counselors in the two counties.

[4] In addition to these 9th-graders, the consortium selected forty 10th graders for the first year of the program.

standards. The recruitment process for the second year focused more consistently on finding students who met the formal selection criteria. With a second group of students who more closely meet expectations, the attitude of the junior high school instructors has improved. However, many of the teachers still feel that Applied Math I is too demanding for most students at the ninth-grade level and believe that only the most capable quarter of the middle 50 percent of students will actually benefit from Tech-Prep as it exists in the Logan consortium. From an outside perspective, the enrollment of more than 100 9th-graders in the electronics program appears to reflect a high level of interest in Tech-Prep that is being channeled into the only available Tech-Prep program. After other program choices become available, enrollment in the electronics program may decline but, as a result, may include only students with the best mathematics aptitude.

The mix of students in the electronics program comes close to matching the overall student population. The racial/ethnic makeup of the 1992-1993 electronics students was representative of the total school population, which is approximately 99 percent white and 1 percent black. About a third of the electronics students in 1992-1993 were female, approximately 60 percent were considered economically or educationally disadvantaged, and 5 percent had disabilities.

So far, consortium leaders have placed the greatest priority on implementing the academic and vocational courses at the secondary and college levels and recruiting students into the program; relatively little attention has been paid to developing systematic work-site experiences to promote career awareness. The only work-site experiences currently provided or planned at the secondary level are visits to local employers in the spring and fall of the 11th- and 12th-grade years. At the postsecondary level, consortium coordinators plan to provide students in the electronics/electrical engineering program with a three-credit internship, but the details of this component remained unclear at the time of the fall 1993 site visit. Work-site experience will be provided to students in the water quality and waste water management program through the implementation of a new apprenticeship program that might, according to one of the local coordinators, resemble other existing co-op programs at the postsecondary level.

D. GOVERNANCE AND RESOURCES

At first, the SWVCC consortium was coordinated by a small leadership group that has since broadened its membership and promoted wide participation in planning. After the initial Title IIIE grant was awarded for fiscal year 1991-1992, the two administrators of the SWVCC campuses and the directors of the Logan and Mingo county vocational schools operated as a governing group until January 1992; they are still considered consortium coordinators. However, a larger steering committee was established in 1992, including three school district administrators, a counselor, three academic teachers, a vocational teacher, a postsecondary administrator and two faculty members, five business representatives (one of whom is a member of the board of education), and two representatives of business and industry trade associations. The consortium has taken an inclusive approach to planning. All steering committee meetings are advertised at all the participating businesses and schools, and anyone who is interested can attend.

Members of the steering committee break into subcommittees for special tasks. Subcommittees have been formed for general curriculum development and for science, English, mathematics, guidance, and technology. Subcommittees meet separately on substantive issues in their area of expertise and then submit recommendations to the steering committee for approval. An ad hoc committee has also been formed to plan approaches to evaluating implementation progress and program effects.

Perkins funding has been the primary but not sole source of support for the development of Tech-Prep in the SWVCC consortium. For development of its electronics engineering program, the consortium received Title IIIE grants for $18,000 in 1991-1992, an increase of $76,300 in the second year, and a $50,050 grant for 1993-1994. The consortium has also received funds from the Southern West Virginia Community College Foundation to support staff development activities for eighth- and ninth-grade junior high school counselors. According to local coordinators, additional state funding will be required to develop the approved water quality and waste water management program and to cover the costs of implementing more Principles of Technology labs.

IX. SALEM, OREGON

Counties surrounding and including Salem, the capital of Oregon, are served by the Region 3 office of the state's system for training and work-force preparation. This region has been designated by the state as a local consortium--the Mid-Willamette Education Consortium (MWEC)--for planning and implementing Tech-Prep and other related education initiatives in the area. The MWEC office and staff, headed by the regional coordinator of professional technical education, are housed at Chemeketa Community College in Salem. MWEC administers and oversees all Perkins grants and other training-related state and federal funds awarded to the region, distributing these funds to individual districts and schools, providing them with technical assistance, and guiding reform efforts. The MWEC region encompasses the service area of Chemeketa Community College--three county-based Educational Service Districts (ESDs) that include 22 school districts and a total of 27 secondary schools. These districts range from small rural ones, with high school populations of 28 to 750, to the much larger Salem-Keizer district, with a total district population of more than 29,000. The region's districts are also quite dispersed, with some schools located more than 30 miles from the main college campus.

For students in the MWEC region who attain technical and academic competencies, employment prospects are somewhat better than those elsewhere in the nation. Salem is experiencing close to six percent annual growth in jobs and is reportedly the 11th-fastest-growing city in the country. Although employment in agriculture, the primary industry in the region, has been declining during the past 10 years, several large employers such as Intel, State Farm Insurance, food processing plants, and hospitals have contributed to recent job growth. The region's largest employer is state government. In late 1993, however, the governor announced large budget cuts after a ballot proposition for a state sales tax to cover education expenditures failed for the ninth time. These cuts may reduce employment opportunities in state government.

Efforts to develop Tech-Prep build on a history of collaboration between the college and secondary members of Region 3, with the college taking the leadership role. Articulation efforts began as early as the late 1970s in Region 3, as well as statewide, in large part because Dale Parnell, Oregon's superintendent of education in the 1980s, was an early leader in the development of a Tech-Prep 2 + 2 model. A structure and process for expanding articulation activities and other collaborations was formalized in the mid-1980s, after the region's members agreed to place the Region 3 office at Chemeketa Community College rather than rotating the coordinator's position among the three ESDs (as was common in other parts of the state). At the time, the college began to offer the Step Ahead Project, which trained secondary teachers to use college curricula for advanced subjects taught in high school, such as entry-level college math. In the late 1980s, the state awarded grants to Region 3 (and other regions) to advance articulation efforts. The grant accelerated articulation by enabling the region to pay for the release time of teachers to work on curriculum alignment. Secondary staff also credit the college with promoting many school reform initiatives and helping with special high school and community events.

In the Salem area, Tech-Prep is being developed as a component of statewide education reform. The Oregon Educational Act for the 21st Century, passed by the legislature in 1991, promotes site-based decision making, certificates of mastery for students who demonstrate competencies, alternative learning environments, integration of social services into school programs, an extended school year, some forms of public school choice for students, and other reforms. Proponents of the bill expect it to foster school and curriculum restructuring, so that students can earn a Certificate of Initial Mastery (CIM) by around the 10th grade, attesting to their mastery of fundamental competencies similar to those defined by the Secretary's Commission on Achieving Necessary Skills (SCANS).

Certificates of Advanced Mastery (CAM), another part of the legislation's general reform plan, are intended to help students organize their course work around a general career direction. Students who earn a CIM will be encouraged to focus their studies in one or more of the CAM programs during the remainder of their high school years. These programs--groupings of relevant academic and vocational courses--will be offered in each of six "endorsement areas": (1) arts and communications; (2) business and management; (3) health services; (4) human resources; (5) industrial and engineering systems; and (6) natural resource systems. According to the Oregon Department of Education, the CAM programs will be designed for all students; they will allow enough tailoring to individual needs and interests to prepare a student for entry to the work force, an apprenticeship, community college, or other higher education.

Tech-Prep in Oregon is a combination of the CAM endorsement areas at the secondary level and the postsecondary occupational programs to which they are linked. Oregon's recent legislation requires that local consortia develop Tech-Prep Associate Degree (TPAD) pathways. Schools and community colleges are expected to define sequences of courses that start with the CAM programs in high school and continue through articulated postsecondary occupational degree or certificate programs.

In the MWEC, centered in Salem, Tech-Prep development so far revolves around three components. *Articulation* of vocational classes is the most prominent feature, but work has begun on defining broader CAM programs. *Curriculum development* efforts have focused on introducing applied academic courses, which are likely to become part of CAM/TPAD course sequences; these courses are available in most of the consortium schools on a limited scale. MWEC staff are also working with individual schools to develop *workplace experiences* for students. The status of implementation for these components is discussed in the next three sections, followed by a brief discussion of consortium governance and resources. In all aspects of Tech-Prep reforms, however, consortium schools are developing their initiatives in different ways and at different paces. These contrasts within the consortium reflect variation in schools' resources and in the level of Tech-Prep awareness and administrative support at the school building level, as well as the challenges consortium staff face in trying to formulate a single model or common vision of Tech-Prep that could apply across all 27 schools.

A. ARTICULATION AND PROGRAMS OF STUDY

Articulated vocational courses are the defining feature of MWEC's and the state's Tech-Prep initiative. Almost all of the consortium's schools have signed articulation agreements with Chemeketa Community College. Secondary students are considered in Tech-Prep if they enroll in a vocational course for which an articulation agreement has been signed. These courses also serve as the foundation for the design of occupationally focused course sequences.

Articulation agreements specify equivalencies between secondary and postsecondary courses. Agreements have been developed between the college and at least one consortium high school for courses in each of the college's 12 areas of professional-technical education, including accounting, agriculture, automotive technology, construction, drafting, early childhood education, electronics, fire science, forestry, hospitality and tourism, manufacturing, and office administration. Within most of these program areas, high school students can earn credits toward a variety of college courses. For example, credit can be earned in high school for as many as 10 college courses in office administration, including business math, business English, office procedures, and word processing procedures. The number of articulated courses varies widely across high schools in the consortium, with a few offering articulated courses in as many as seven or eight program areas. The range of articulated vocational courses in a high school usually resembles the range of its existing vocational courses, because most schools are trying to articulate all of their vocational courses. Accounting and office administration are the most common vocational courses, and more than 20 of the 27 schools have signed articulation agreements for courses in each of these areas.

Students can earn college credit only if they complete a competency assessment for the articulated course. They must either pass an exam, developed jointly by high school and college faculty, or for courses in which portfolios are appropriate evidence of accomplishment, a competency folder review (for example, in drafting) with a grade of B or better. The competency assessment appears, in at least some vocational programs, to represent a serious standard. In school year 1991-1992, for example, 97 students took exams to earn credit for accounting procedures, but only 6 received a passing grade and earned college credit. In other program areas, such as early childhood education, almost all students who completed the exam for the articulated course earned credit. (The number of credits earned varies by course.)

"Design teams" of high school and college instructors who teach the relevant courses develop the terms of articulation agreements. Some of the teams, which are structured around the college's 12 technical program areas, were formed as early as the mid-1980s. The design teams identify competencies for which credit will be granted, agree on course outlines and textbooks at the secondary and postsecondary levels, and develop competency exams that determine whether students receive college credit. After these specifications have been developed, any high school in the consortium can agree to adopt them and sign an articulation agreement with the college.

In two respects, the design teams sometimes play a broader role than simply developing articulation agreements. First, as programs for new occupational areas are developed, new design teams are created to develop curricula and, in the process, to create an articulated set of courses spanning high school and postsecondary study. For example, a new team has been formed for health occupations. Second, the design teams can be a forum for ongoing collaboration; some teams continue to meet, although less frequently, after articulation agreements have been signed. For example, the manufacturing design team met once or twice a month while it was revising curricula and working on articulation, but meets a few times a year now that the agreements have been finalized. To the extent they remain active, design teams can become a structure for making curriculum and textbook changes, as well as for offering professional networking and staff development activities, which are particularly important for secondary teachers.

The design teams have also begun to facilitate the development of TPAD pathways in each occupational area. In school year 1993-1994, the WMEC region's Title IIIE funds were committed to defining TPAD pathways in the industrial and engineering and office administration program areas. In fall 1993, a small group of high school, college, and consortium staff had already begun to define a sequence of courses for the secondary industrial and engineering CAM and variations of it at the secondary level that can lead to various college programs in electronics, drafting, and manufacturing. Consortium staff hope that, after these pilot efforts have established some model pathways, the development of TPAD pathways in other CAM areas will become the responsibility of design teams. College and consortium staff are even discussing the possibility of restructuring the design teams around the six CAM endorsement areas, rather than the 12 existing college program areas.

The NWEC longer-term vision is that high schools will identify broad CAM course sequences and perhaps even specialized variants at the high school level. These sequences would lead to most or all specialized degree programs at Chemeketa Community College and, in some cases, beyond. Consortium staff hope that high schools will develop variants within the six CAM endorsement areas to allow high school students to begin tailoring their course selection to the specialized college program they anticipate entering. One example of this tailoring already exists: the pathways defined in the industrial and engineering CAM area include general preparation for college-level work as well as secondary-level options to help students prepare specifically for college programs in electronics, drafting, or manufacturing. Most pathways will rely at least initially on existing academic and vocational courses, but some new courses and workplace experiences are envisioned to help students achieve outcomes specified in the education reform legislation.

However, the size and resources of individual consortium schools are likely to constrain their ability to develop pathways. At the secondary level, the main difference among pathways is the specific articulated vocational course. Some schools--particularly the smaller rural ones--have limited vocational offerings and are likely to have difficulty developing distinct pathways, even for the six

CAM areas. Some may develop six distinct CAM pathways while lacking the range of resources needed to differentiate at any more specialized level--for example, between manufacturing and mechanical design within the industrial and engineering CAM area. MWEC is considering some ways to supplement local offerings and thus overcome these constraints, including busing students to other schools, providing courses through telecommunications, and offering special summer programs at the college.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Implementation of new curricula during the past several years has focused on introducing more applied curricula and instruction. Consortium staff hope that applied academic courses will eventually be an option within each CAM program. As of fall 1993, individual schools in the consortium had embarked on this path to varying degrees.

At least one academic course identified as "applied" was available to students in 20 of the 27 consortium high schools in fall 1993. Curricula from the Center for Occupational Research and Development (CORD) had been available through the Oregon Department of Education and the Region 3 office for several years. These curricula have not been widely adopted, however, partly because state colleges and universities have been slow to recognize them as academic courses for purposes of admission. Some high schools have tried to modify the CORD curricula or to develop local versions of applied academics, either because the commercial materials were perceived as not meeting teachers' and students' instructional needs, or to make the courses acceptable to the college and university system. Most of the high schools offer Applied Math, about one-fifth offer Principles of Technology (renamed "Applied Physics"), and a few offer applied courses in biology or chemistry. Applied communications courses, available in about eight schools, have in most cases been developed by teachers and district staff. Applied academic courses are open to all students; there is so far little attempt to coordinate scheduling so that students in occupational courses can take courses with an applied curriculum. In fall 1993, most schools offered limited sections of these courses.

Attempts to bring about curriculum change and new teaching strategies have encountered obstacles in many of the consortium schools. Some teachers and counselors still consider applied academic courses as appropriate only for students with academic difficulties. This view limits the number of students guided to take the courses and, as a result, the number of sections that can be offered. In one school, the English Department supported an Applied English class primarily because it removed special education and at-risk students from other English classes. Principles of Technology is an exception; it draws students with a wider mix of academic abilities. Adoption of team teaching and common preparation periods for teachers from different disciplines has also been hampered in some schools. One school, for example, wanted to offer an upper-level science course in a special lab in which both the science teacher and a manufacturing vocational teacher would lead instruction. This effort was thwarted by cost and scheduling constraints, however.

At the college level, efforts have been under way to implement academic courses with more applied learning techniques. Some sections of an English course required for students in occupational degree programs have been modified to emphasize particular occupational areas; students in these occupational programs are encouraged to enroll in the relevant sections. For example, students in the auto technology program take a communications course that includes, for a partition and classification exercise, the task of listing components for a 1968 Corvette.

C. RECRUITING, GUIDANCE, AND CAREER DEVELOPMENT

Although the focus of Tech-Prep development in the MWEC region is on defining course sequences related to particular occupational directions, Tech-Prep is more of a concept than an identifiable program. CAM endorsement areas at the high school level are linked through articulated courses to postsecondary programs, to create TPAD pathways. However, students make no conscious choice of Tech-Prep, are not recruited to Tech-Prep, and do not identify themselves as "Tech-Prep students." To describe the population that might eventually complete a TPAD, the state has defined Tech-Prep students as all those who are enrolled in any articulated occupational course, because this group is most likely to follow TPAD pathways. In MWEC, approximately 16,000 such students from 26 secondary schools were identified in school year 1992-1993. This figure represented close to 90 percent of the student population in these 26 schools. The high proportion of students formally identified as in Tech-Prep reflects the fact that most high school students in the region take some type of occupational course--most often keyboarding--and the majority of these courses have been articulated. It is quite unclear, however, how many of these students actually planned to pursue a community college program related to the occupational course they were taking.

The reforms promoted by the 1991 state legislation are likely to prompt increasing attention to career development in the next several years. Secondary schools are required to implement course sequences in the six CAM career areas by 1996, and a few in the consortium are already beginning to take steps to meet this goal. For students to make choices about which CAM to pursue, they will need information and guidance about, and possibly exposure to, occupations in these broad career areas.

As career guidance and workplace activities develop, they will be available generally to all students, but they are likely to continue to vary widely within the consortium, just as they do now. Some schools have career centers, some encourage teachers to schedule guest speakers for classes during career awareness days, and some make job shadowing or other workplace experiences available to interested students. One of the more common approaches to career guidance and development throughout the consortium involves requiring students, generally 10th-graders, to complete interest inventories at the career center. In some schools, students use information from these assessments to write and present papers on a specific career, usually as part of an English class assignment. Region staff are currently developing a computer-based "career path planner" system, which will help students to identify occupational interests, print out available course sequences that will help them prepare for these occupations, and provide information about postsecondary institutions offering relevant degrees.

Opportunities for workplace experiences also vary across schools. The larger high schools in or near Salem provide more opportunities than the more rural schools. Many of the high schools had work experience coordinators in the late 1980s, but these positions have generally been eliminated because of budget cuts. Some of the schools had developed job banks that coordinators used to find placements for students participating in cooperative education or other work-study arrangements. Chemeketa Community College is working with these high schools to redevelop and upgrade these employer connections and systems, in an effort to move toward a school-to-work system.

The consortium has also supported several efforts to place students in work-site positions. Collaborating with the three local Job Training Partnership Act (JTPA) offices and the Department of Employment, the MWEC region had funded programs to place special needs and at-risk vocational students in workplaces. Approximately 180 students participated in these after-school activities during school year 1993-1994, about half in paid jobs and the remainder in unpaid internships or job shadowing. MWEC staff have tried to ensure that these placements are related to students' vocational program. They have also been working on linking placements for disadvantaged students participating in the Summer Youth Employment Program to the vocational courses they take during the school year.

With the Department of Employment, MWEC also implemented a pilot project in one school to use the department's database to find employers who could accept students for a variety of workplace activities, including job shadowing and cooperative education placements. The database provides contact information and job descriptions for career center staff, to help them make placements, and also allows staff to document and track employer involvement in the project. During summer 1993, department staff solicited new employers for the database, particularly in a few occupational areas related to classes taught by teachers willing to release students for work-site experiences. Some staff and students from the school took part in a short summer internship at the department to learn about the database system; the student interns then helped other students complete forms requesting jobs, community practicums, and other work-site experiences. By late fall 1993, the school had placed several hundred students in job shadowing through this system. Building on this early experience, career center staff at the school expect that job shadowing will be included for all 10th-graders as part of their required consumer economics course in school year 1994-1995. This effort has to overcome some obstacles, however; 10th-grade students are too young to have driver's licenses, and public transportation from the school is limited. Moreover, some teachers and department chairpersons have resisted authorizing release time from class for students to participate in these experiences. For the most part, however, schools and employers have been increasingly enthusiastic about the project. By fall 1994, MWEC expects to implement the system in all six Salem schools and in several of the consortium's more rural schools.

D. GOVERNANCE AND RESOURCES

In 1985, a steering committee was formed to oversee Region 3 funding and activities. The committee includes administrators from the college, ESDs, and school districts, as well as representatives from JTPA, the state Bureau of Labor, and local businesses and corporations. Originally formed to satisfy requirements for Perkins Act funding, the committee now functions as a policymaking board for all Perkins and related initiatives. Tech-Prep is one of several reforms that fall under the committee's jurisdiction; although the committee meets monthly, not all sessions focus on Tech-Prep issues.

MWEC staff function as the liaison between this Region 3 steering committee and high school and college administrators, teachers, and counselors. The staff include the regional coordinator--who directs the Region 3 consortium--clerical support, and two full-time-equivalent Tech-Prep coordinators, one of whom is a college faculty member on loan to the office. These coordinators identify the need for design team meetings, facilitate the meetings, and follow up with individual teachers and school administrators. The MWEC office as a whole administers funding, including the Title IIIE grants ($118,500 for 1992-1993), and provides technical assistance to facilitate collaboration among the consortium members and to promote work-force preparation reforms. The consortium staff also identify members' staff development needs, host regional events, pay for release time for teachers and others to participate in staff and curriculum development activities, and purchase equipment and curricula for school use. In addition, region staff are responsible for tracking the numbers of students in each articulated course, the competency exams taken, and the credits earned under articulation agreements.

X. SPRINGDALE, ARKANSAS

In mid-1991, four institutions in northwestern Arkansas formed a Tech-Prep consortium based in Springdale. These institutions--Springdale High School, Northwest Arkansas Community College, an adult postsecondary vocational school called Northwest Technical Institute, and the Springdale Chamber of Commerce--continue to work together. The consortium also cooperates closely with a Tech-Prep consortium in an adjoining school district and the Northwest Arkansas consortium, a confederation of 18 secondary school districts that predates the Tech-Prep initiative and serves a broad information-sharing function.

The economic climate and outlook for the future are strong in Springdale and the northwestern part of Arkansas. The area around Springdale, a city of 33,000, had a 1993 unemployment rate of only 2.5 percent and a diversified industrial base. Strong employment, in fact, poses a challenge to educators: they must work to keep students in school who can leave before graduation and find employment. Major employers like Tyson Foods, Danaher Tool Group, and the local hospital each provide jobs for more than 900 people. Midsize firms employing more than 250 include the turkey processing division of Cargill, Inc., aluminum extruder Kawneer Company, Heekin Can Company, and Northwest AR Paper. These and a wide range of smaller employers need skilled workers with computer and technical skills, and local demand for such workers is expected to increase during the next five years. Growth is likely to be fueled by the recent approval of a new airport that will add 2,000 jobs to the local economy, the planned construction of a $25 million facility to rebuild aircraft cockpits, and the projected construction of a four-lane highway in the area.

Before initiation of reforms associated with Tech-Prep, relationships between business and the public education system were cooperative but mostly informal. These relationships have generally revolved around single issues or events rather than sustained joint endeavors. The Chamber of Commerce education subcommittee was instrumental in establishing Northwest Technical Institute in 1975 and has supported it ever since. In 1991, for example, members successfully intervened to avert its threatened shutdown. The Chamber of Commerce has also been involved in teacher receptions, academic awards, honorary banquets, and monetary awards for outstanding student performance.

Guidance from the state has determined some of the elements of the local Tech-Prep initiative. The Department of Education has defined a Tech-Prep high school diploma, as well as courses that students must complete and the minimum grade point average (2.75) that they must achieve to earn this diploma. Teachers must participate in state training for certification to teach a work-readiness course required for the Tech-Prep diploma. If a local consortium is introducing applied academic curricula, teachers are also required to take part in state training sessions to become familiar with the new curricula and instructional concepts.

A. ARTICULATION AND PROGRAMS OF STUDY

In Springdale, the goals of Tech-Prep are to eliminate the general education track, encourage all students to plan beyond high school, and challenge students more than they typically would be by the general or vocational education tracks. Three components are salient in the approach adopted to pursue these goals. First, the consortium has been defining comprehensive six-year "drawing boards," or sequences of secondary and postsecondary courses to enhance an earlier, more course-oriented approach to articulation. Second, Springdale High School has incorporated into these drawing boards some applied academic curricula, to present greater academic challenges to students who choose to follow a career-oriented drawing board. Third, the high school has created a guidance process (see Section C) for all students, designed to ensure that they develop a plan leading either to a four-year college or to a pathway defined by one of the career-oriented drawing boards and culminating in a community college credential.

A major focus of the Tech-Prep effort is broadening the concept of articulation to create comprehensive drawing boards. Previous articulation agreements among Springdale High School, Northwest Arkansas Community College, and Northwest Technical Institute focused on identifying the secondary courses and competencies for which postsecondary credit could be granted, as well as the conditions under which credit could be granted. The current intent is broader--to identify comprehensive, six-year sequences of academic and vocational courses. These drawing boards will detail the entire sequence of courses in grades 9 to 12, as well as in two years of community college, for each of 14 occupational specialties. For each of these specialties, a secondary program exists that can lead to related programs at the postsecondary level. These occupational specialties are grouped, for purposes of defining the secondary portion of each drawing board, into five broad clusters: (1) agriculture; (2) business and marketing; (3) trade and industry; (4) home economics/child care; and (5) child care/guidance management. The local coordinator hoped to have the new six-year drawing board agreements finalized by the end of school year 1993-1994, but guidance counselors were already using drafts of the drawing boards during that school year.

Creating the full range of articulated drawing board sequences entails negotiating additional agreements on the equivalences between secondary and postsecondary courses, and this process has presented some challenges. Because high school classes must be aligned with courses taught at two postsecondary institutions--the community college and the technical institute--both of these institutions must be involved in course reviews. The institutions organize the scope and content of their courses independently, using different credit systems (the college's Carnegie units and the institute's clock hours). Reconciling course differences and credit equivalences has required long meetings among busy instructional staff from all three institutions.

Efforts have also been made to streamline the process for granting college credit. Under the more traditional articulation agreements, students earned college credit either by getting certain course grades in high school or by achieving a specified score on a special advanced placement exam. In the consortium's overall plan, credit will instead be granted on the basis of a final course examination at the high school level, which will be designed jointly by secondary and postsecondary instructors. This effort was under way in fall 1993.

Program development plans set forth in fall 1993 included two additional features that would involve articulation and development of occupationally oriented programs of study. First, the consortium was exploring possibilities for articulation at the postsecondary level--transfers of credit from the consortium's two-year institutions to a four-year state college, as well as transfers of credit within the consortium between the community college and the technical institute. Local consortium leaders believe that arrangements for credit transfer to four-year colleges will allow students to apply the credit at any state college campus, although the process by which this statewide articulation will be negotiated was not yet clear during the initial site visit. The consortium was also planning in fall 1993 to implement a new health occupations program in the following school year. The program would be modeled after the Boston-based Project ProTech and would target specific occupations, such as medical transcriptionist, physical therapist, nurse assistant, and medical assistant. This program, which would involve students in job shadowing and possibly other forms of workplace experience at the local hospital, would constitute a sixth career cluster.

All of the occupationally oriented drawing boards developed in Springdale incorporate requirements for academic, occupational, and general career development classes--some established by the state and some by the local Tech-Prep plan. Each drawing board reflects the state's requirement that all students take three years of mathematics and four years of English to graduate, and increases the state requirement of two years of science to three. Students who choose an occupationally oriented drawing board meet these requirements in part by taking applied academics classes--Math Tech I and II in grades 9 and 10 or 10 and 11, English Tech in 12th grade, and Principles of Technology I and II in 11th and 12th grades.[1] The drawing boards call for a total of four credits (years) of vocational courses directly focused on the student's chosen career direction, as well as two additional credits in vocational courses related to that concentration.[2] Each drawing board also includes the following requirements for general introductory courses, established by the state for a Tech-Prep diploma:

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[1] Consortium staff made a conscious decision to label these courses with the suffix "Tech," rather than to call them "applied," because the latter term might connote a less demanding curriculum. The mathematics courses, Principles of Technology, and the English Tech class for 12th graders were (continued...)

- A one-semester course on personal and family life skills that can be taken at any time in grades 7 through 10
- A one-semester career orientation course in seventh or eighth grade
- A one-semester technology education and a one-semester computer keyboarding course at some point in grades 8 through 12
- A one-semester workplace-readiness course at some time in grades 10 through 12[3]

The combination of state and local drawing board requirements has raised some concerns that fulfilling them may limit students' flexibility. The local coordinator thought that the number of credits required for a high school diploma might make it difficult for students who choose a drawing board sequence after ninth grade to complete the occupational courses required at the secondary level.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Curriculum changes in Springdale have focused on the introduction of more applied content and instructional approaches in academic classes at the secondary level. College and business partners

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[1] (...continued)
being taught for the first or second time in fall 1993, although the English Tech curriculum was still evolving.

[2] Requirements for both the Tech-Prep and College Prep diploma are extensive, so students who remain undecided about their postsecondary direction through 9th grade or 10th grade may have difficulty meeting these requirements after they eventually decide. For example, two years of a foreign language are required for admission to state four-year colleges. To give undecided students some flexibility, the consortium allows foreign languages to count toward satisfaction of the "related vocational" requirements for a Tech-Prep diploma.

[3] Students are encouraged to take the workplace-readiness course in the semester before they start any type of part-time employment [that they found on their own or through the school's co-op program].

have been involved primarily as reviewers of curriculum material proposed by the high school. Changes in the postsecondary curriculum are likely to be considered later, after Tech-Prep students reach the college.

Logistical constraints have led the consortium to depart from a committee approach for curriculum development, in favor of a more sequential review process. Originally, the consortium tried to form subcommittees of high school and postsecondary faculty and business members for curriculum development. However, high school administrators and department heads complained that this approach took teachers out of their classrooms for meetings too often. Instead, the local coordinator conducted initial reviews of commercially available curriculum materials. She then submitted her recommendations in turn to high school instructors, their postsecondary counterparts, and finally to business and industry representatives. The local coordinator then worked with the secondary and postsecondary staff to make final revisions, before the curriculum was submitted to the governing board for final approval.

The resulting curricula adopted in the high school--in Applied Mathematics, Principles of Technology, and Applied Communications--have had some visible effects on what goes on in the classroom. Instructors of these classes report placing much more emphasis on hands-on and cooperative learning than they have in previous courses. The high school math and science teachers confirm that the Math Tech and Principles of Technology courses, as intended, are demanding more from students than the general math and science courses they replaced. According to high school faculty, the introduction of applied curricula and the attendant staff development sessions have had a broader effect as well. Several of the labs now being used in Math Tech I and II are being used by teachers in College Prep math classes. These teachers are also using more cooperative learning approaches.

Classroom activities observed in fall 1993 illustrate the direction of curriculum change:

- In a Math Tech class for 10th-graders, students used a stopwatch to clock a model car moving across a calibrated surface and then calculated its speed. They spent the next class period practicing time, rate, and distance calculations in a traditional classroom setting. Students who were having trouble with the calculations were paired with other students for help, while the teacher circulated and answered individual questions.
- In a Principles of Technology class for 11th-graders, the instructor demonstrated how to set up a water pump for a lab on calculating work in a fluid system. In the next class period, students actually conducted the lab exercise.
- In an English Tech class, 12th-graders worked part of the time in a computer-equipped writing lab composing business letters and resumes. During one session, the teacher gave a group presentation emphasizing organization and grammar, including the use of complete sentences, proper sentence structure, punctuation, and spelling. The following day, students worked individually at personal computers as the teacher circulated and answered questions.

In these observations, the activities begun one day and continued the next illustrate one type of difficulty that Springdale staff have encountered in implementing applied academic curricula. The high school schedule is made up of seven 50-minute class periods, and students attend the same classes every day on this schedule. As a result, the preparations--conceptual introduction, discussion, and equipment setup--for hands-on learning activities must usually occur on one day, and the actual work or the exercise on the next day. The continuity of students' work is often disrupted as a result, and teachers must work to refocus students' attention on an exercise introduced the previous day. Instructors of applied classes would like to shift to longer classes that meet fewer times per week, but there does not appear to be any immediate prospect of such a change.

Consideration of the possible need for curriculum changes at the postsecondary level has been deferred. Postsecondary administrators and faculty believe the initial focus of Tech-Prep development efforts should be on efforts to bring secondary curricula in line with existing postsecondary curricula, and to establish course equivalencies so that students can avoid redundant courses. Issues such as how--or whether--to modify postsecondary technical courses to build on better high school preparation, or to enhance the effectiveness of academic classes, are being put on hold until Tech-

Prep students reach the college level, and college staff can gauge the effects of secondary changes on students' skills.

A great deal of effort has been put into staff development to facilitate curriculum changes. In 1992-1993, invitations to participate attracted 105 academic staff and counselors and 30 vocational instructors, who voluntarily attended some of the staff development sessions related to Tech-Prep at the local level. Furthermore, 20 teachers of math, English, or science took state-level sessions required for certification to teach applied academics. Five other teachers have been certified at the state-level to teach workplace readiness. The consortium planned to require participation in staff development in 1994-1995 for relevant staff. Staff development sessions were conducted by the local coordinator, American Vocational Association, Center for Occupational Research and Development (CORD), Southern Regional Education Board, and Arkansas Department of Vocational Education.

C. RECRUITING, GUIDANCE, AND CAREER DEVELOPMENT

Although introduction of applied academic curricula and the development of six-year drawing boards will most directly affect students bound for two-year postsecondary programs, the Springdale consortium is highlighting the schoolwide nature of its reforms. Considerable emphasis is placed on a guidance process that will apply to all students, requiring them to develop a Career Action Plan (CAP) that extends beyond high school--either to four-year college or to postsecondary study relating to a particular occupational field. No effort is made to promote a program called "Tech-Prep," and students who choose an occupationally oriented drawing board do not identify themselves as "in Tech-Prep." This approach was adopted because of concerns about historically negative attitudes toward vocational education.

Efforts to promote interest and support have focused instead on curriculum changes, the guidance process, and the importance of thinking about future career directions. Brochures have been developed to inform parents about curriculum changes, including the introduction of the new "Tech" classes in mathematics, technology, and communications. At a job fair organized by the

Chamber of Commerce, students selected to represent each classroom visited employers' booths, obtained information about the skills and education required for various jobs, and reported back to their classmates--a way, planners hoped, to increase students' awareness of area industries and potential careers in these industries.

The newly developed six-year drawing boards are part of an ongoing guidance process for all students, beginning in eighth grade and extending through high school. In eighth grade, students complete a Career Assessment Battery (CAB) that provides information about their learning styles, aptitudes, and career interests. They then meet with a guidance team, consisting of a junior high school teacher and a senior high school teacher, to discuss the outcomes of the assessment and to complete a CAP.[4] In completing the CAP, students are asked to identify three broad career areas that interest them from a list that encompasses all occupations, and to indicate the education or training they expect to pursue after high school. Students whose interests and CAB results suggest that they will not attend a four-year college also select, with the assistance of the guidance team, a six-year occupational drawing board to guide their selection of classes in ninth grade and later years.

Each year, all students review their career directions and reassess their interests, abilities, and educational plans. The junior and senior high school teachers meet with students in ninth grade to review the CAP and, if relevant, the six-year drawing board. In 10th grade, students take the Armed Services Vocational Assessment Battery (ASVAB) to reassess their career interests and abilities. They then meet with the senior high school teacher to review and make adjustments to the six-year plan. The 10th-grade counseling also provides an opportunity to give students information about local incentives to complete their six-year plan, such as the possibility of taking courses for a reduced rate at the community college if they achieve a minimum score or better on the final articulation examination. In 11th grade, formal responsibility for counseling shifts to regular guidance counselors, and the process focuses more closely on graduation requirements, progress toward graduation, and further steps in the relevant six-year drawing board. Twelfth-grade counseling focuses on credits needed for graduation, registration for college-entrance tests, if appropriate, and procedures for obtaining financial aid for postsecondary education. All 12th-grade students and their parents are required to attend a financial aid workshop with counselors, to review the costs and financing of postsecondary education.

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[4] Guidance teams at this level are composed of a junior and a senior high school teacher to make up for a shortage of regular guidance counselors.

Given the universal guidance process for all students and the intentional avoidance of a distinct Tech-Prep program identity, the Springdale consortium does not specifically recruit students to a Tech-Prep program and does not identify a student as a "Tech-Prep participant." It is possible, however, to characterize the level of student involvement in components such as vocational education and six-year articulated drawing board plans. Students whose postsecondary plans do not include matriculation to a four year college or university, and who choose an occupational drawing board and take one or more vocational courses, make up more than 40 percent of the students in Springdale High School. These students might be considered the "Tech-Prep population." They reflect the demographics of the school, which is 99 percent white and 1 percent Asian.

The focus on career direction for these students includes efforts to expand workplace experience and opportunities for career exploration. In fall 1993, only limited workplace experience was available, through a co-op program that provided opportunities for students in the agriculture and business/marketing clusters. Current plans will expand these opportunities. The health occupations program, modeled on Project ProTech, slated to begin in school year 1994-1995, will entail substantial work-site activity. Workplace experience will also be stressed in a youth apprenticeship program in banking and finance that is to begin in 1994-1995. Plans are also under way for a career counseling center to provide occupationally specific career guidance, with students required to complete certain activities each year beginning in the ninth grade.

D. GOVERNANCE AND RESOURCES

The Springdale consortium's structure and style of governance reflect the small size of the community it serves. On the one hand, governance is informal; a relatively small board makes key decisions, but the high-school-based coordinator works out most issues through personal contact with interested parties in the high school, postsecondary institutions, and the business community. On the other hand, this small consortium is linked to other individuals working on Tech-Prep in Arkansas, in an effort to coordinate and share information.

Outside links are most apparent in the structure of the governing board. The board includes four members from the three educational partners: (1) the local Tech-Prep coordinator from Springdale High School; (2) the president and the dean of student services at Northwest Arkansas Community College; and (3) the director of student services at Northwest Technical Institute. It also includes, however, two "outside" members--the Tech-Prep coordinator from Rogers High School, which is also linked in a consortium to the same community college, and a representative from the Northwest Arkansas consortium of 18 school districts--a confederation that deals with a wide range of educational issues other than Tech-Prep. This governing board serves as the decision-making body for both the Springdale and Rogers consortia, which received separate Tech-Prep consortium grants but work with the community college (in some respects as a single consortium).[5] Information on Tech-Prep development is being shared by these two overlapping consortia--among the earliest Tech-Prep grantees in the state--with the various districts that make up the Northwest Arkansas consortium and that are beginning to implement their own Tech-Prep programs.

Within the Springdale consortium, the local coordinator is the hub of most activity. The coordinator, housed at the high school campus, reviews funding needs, allocates Tech-Prep monies, leads curriculum development and selection efforts, and brings recommendations to the governing board for its approval. The local coordinator has a close working relationship with members of the Springdale Chamber of Commerce, particularly the district superintendent, who is a leading member of the Chamber's education committee and a strong supporter of Tech-Prep reforms. Although business and industry are not formally represented on the governing board, the coordinator can use informal communications to get input and help from Chamber members, when necessary.

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[5] Information obtained after the site visit suggests that the Springdale and Rogers consortia may formally consolidate.

Support for Tech-Prep development in Springdale has come from several federal and state sources for vocational education. In 1993-1994, the consortium received $106,000 in its third year of Perkins Title IIIE funds, $63,325 in Perkins Title IIC funds, $25,960 in state vocational start-up funds for the Principles of Technology and workplace-readiness courses, and $21,742 in state vocational equipment funds for lab materials. Most of these resources were spent on curriculum development and acquisition, the consortium coordinator's salary and benefits, and staff development activities. Looking to the future, the local coordinator believes that schoolwide reform efforts will be sustained by local funding, but expanding the use of applied academics, particularly laboratory-based courses like Principles of Technology, will require additional outside funds.

XI. SPRINGFIELD, MASSACHUSETTS

The Tech-Prep consortium in western Massachusetts was created by three community colleges and secondary schools in eight local and intermediate districts. In 1991, Springfield Technical Community College (STCC), Holyoke Community College (HCC), and Greenfield Community College (GCC) entered into a working agreement with three area vocational schools, four vocational schools operated by individual local school districts, and the vocational component of a comprehensive high school. By its third year, 1993-94, the "Tech-Prep West" consortium had expanded to include two four-year institutions--the University of Massachusetts at Amherst and Westfield State College. This initial profile of the consortium's progress is based largely on examination of how Tech-Prep has been implemented to date by two of the largest consortium districts--Springfield and Chicopee--and the largest of its community college members, STCC.

The areas served and the labor markets targeted by this Tech-Prep consortium are diverse. The school districts and colleges serve a broad area that stretches roughly 30 miles north to south along the Connecticut River valley. It includes cities with old manufacturing sectors, such as Springfield, Holyoke, and Chicopee, as well as more suburban and rural areas. The largest vocational school, in Springfield, has a student population that is about 26 percent white, 32 percent African American, and 40 percent Hispanic, while one of the other large vocational programs, in Chicopee, has an almost entirely white student body. Springfield, the major urban center, has a population of about 160,000. It has a shrinking manufacturing sector, but is experiencing employment growth in health care. According to school officials, several major manufacturers--such as American Saw and Manufacturing, Milton Bradley, and Leggo--are expanding their operations and employment in the greater Springfield area.

Tech-Prep follows earlier efforts by individual colleges and school districts to develop program linkages and innovations, and other ongoing initiatives parallel and complement the work being done under the Tech-Prep grant. Beginning in the late 1980s, STCC developed articulation agreements with several vocational schools in Springfield and surrounding areas, focusing on identifying equivalences between high school and community college courses that would allow students to gain college credit for high school courses. At the vocational school in Springfield, changes in mathematics instruction have been gradually adopted over the past several years, based on standards issued by the National Council on Teaching of Mathematics. The Springfield City Schools recently received a grant to support integration of vocational and academic curricula; in 1993-1994, the vocational school was conducting a pilot implementation of a plan to cluster students enrolled in a particular vocational program together in academic classes, where the curriculum could then be tailored to their occupational studies.

Tech-Prep in this consortium, at least in its early stages of development, is primarily an effort to improve vocational education. At the end of eighth grade, students choose whether to attend a four-year vocational school or an academic, college-prep high school. All students who are considered Tech-Prep participants in school year 1993-1994 attend vocational high schools. Although guidance orientations for eighth-graders provide information generally about all vocational programs and specifically about the special features of Tech-Prep, the major choice students face is the traditional one between the vocational and college-prep schools. In ninth grade, vocational students participate in a year-long exploratory rotation among different vocational programs; at the end of ninth grade they choose their three-year secondary vocational program. The changes introduced by Tech-Prep are aimed at enhancing the rigor and appeal of the vocational option, and the likelihood that students who choose it will go on to postsecondary study. In the consortium's largest few school districts during the 1993-1994 school year, the implementation of Tech-Prep so far consisted primarily of three changes:[1]

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[1] Plans for other Tech-Prep components exist, however--most notably for development of a sequence of workplace activities including systematic job shadowing in 11th grade, general participation in coop jobs in 12th grade, and "pre-apprenticeship" placements during the first year of community college.

1. Expanding the range of high school vocational programs that are articulated with community college programs, and increasing the number of high school/college pairs that have articulation agreements in particular occupational areas
2. Developing and gradually adopting applied curricula for use in the vocational track math, science, and English classes
3. Promoting interest among vocational students in postsecondary education, and thus in choosing articulated programs and higher-level academic classes

The following four sections discuss these three main components of Tech-Prep, as well as its governance and leadership.

A. ARTICULATION OF VOCATIONAL PROGRAMS

Articulation has been going on since the late 1980s in the Tech-Prep West area. By mid-1991, STCC had articulation agreements with six of the eight consortium vocational schools, as well as other schools, both academic and vocational, that are not part of the consortium. STCC had agreements with individual high schools for a total of 11 different vocational programs, offering college credit to students in high school programs in electronics, commercial art, printing, heating/ventilation/air conditioning (HVAC), drafting, health assistance, electrical trades, machining, computer science, and horticulture. HCC and GCC had similarly begun articulation for a narrower range of programs.

These articulation agreements specify equivalencies between vocational courses at the high school and college levels, rather than defining overall programs of study spanning secondary and postsecondary years and the academic and vocational courses to be taken at both levels. The emphasis in the articulation process is on identifying the three-year sequences of high school vocational courses taken in grades 10 through 12 for which college credit can be earned, and the various specialized college programs toward which the credit can be applied. For example, students who complete a three-year high school course sequence in electronics could receive credit toward Associate of Science (A.S.) degrees in electronics, computer maintenance, laser electronics/optical technology, or biomedical instrumentation. In most cases, articulation agreements allow students to receive credit for the introductory college course related to their high school vocational sequence--such as Electronics I--on the basis of adequate grades and the high school instructor's recommendation. However, the colleges also offer a "challenge exam" option; students who did particularly well in high school can take a test which may earn them further course credits.

Since receipt of the first Tech-Prep grant for school year 1991-1992, the range of articulation has increased substantially. Vocational school students can now earn credits in a total of about 17 college-level programs, including culinary arts, business administration, marketing, early childhood development, automotive technology, office administration, biomedical instrumentation, graphic arts and communications, office administration, robotics, landscaping and plant science, computer assisted design and manufacturing, energy systems, and telecommunications. There are still vocational programs, however, that are articulated with college programs at some high schools but not at others. For example, HVAC students from one high school in the consortium can earn college credit in an energy systems program, but students from a similar program at another high school going to the same college must begin with the introductory course.[2]

Students choose a vocational program much as they did before. The advent of Tech-Prep may affect the academic courses they take and their options for obtaining early college credit for vocational courses. However, it does not appear that high school students, in choosing the vocational school, develop a full program of academic and vocational classes that will culminate in a degree in an occupational specialty as defined at the postsecondary level.

The focus of articulation on vocational course credits rather than on a complete academic and vocational program is probably related to the way in which articulation agreements are developed and the staff involved. Articulation between high school and college--at least in Springfield and possibly the other colleges--begins with a high-level "agreement to articulate" signed by the college president and the chair of the local school committee. Once this general agreement is reached, negotiations are held entirely between the college and high school department faculty who teach the technical or vocational programs under consideration, and do not include academic instructors or counselors. According to some high school faculty, the process primarily lays the burden on them to initiate discussions and assemble materials to demonstrate to the college faculty's satisfaction that the high school vocational curriculum, if successfully completed, is equivalent to particular courses taught at the college level. In one high school, faculty noted that without offices, telephones, or clerical support, it is a substantial challenge--when added on top of their normal teaching workload--simply to set up meetings and put together the required materials to qualify their program for college credit.

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[2] An accomplished student in such circumstances might be recognized by college faculty as suitable for placement in a more advanced course, most likely by taking a challenge exam. In the absence of the articulation agreement, however, such advanced placement is less probable.

Articulation as defined in the Tech-Prep West consortium can shorten the time students need to satisfy requirements for an A.S. degree, but it also represents part of an emerging strategy to promote students' acquisition of more advanced skills. In Springfield, for example, college administrators express interest not only in helping students graduate more quickly, but also in defining programs that impart and give credentials for higher skills. The college is considering developing honors A.S. programs, and even four-year Bachelor's degree programs in a few selected technical fields. According to college staff, however, for students to attain these advanced skill objectives they must enroll not only with technical course credits under vocational articulation agreements, but also with solid math and English skills so they can avoid spending time in remedial classes. This concern is addressed by efforts at the secondary schools to strengthen the academic curriculum and instruction.

B. CHANGES IN CURRICULUM AND INSTRUCTION

Much of the effort to implement Tech-Prep has gone into developing and implementing high school applied academics curricula to strengthen the vocational track in math, science, and English. Although all students in the target population attend vocational programs, their schools offer both college-prep and vocational-track science and English classes. In math, the largest high school has offered four levels of instruction: (1) college-prep honors; (2) college-prep; (3) vocational; and (4) basic-skills classes. Vocational students may take some college-prep classes and some vocational-track classes in math, science, and English, depending on their strengths and weaknesses.

Curriculum definition has progressed in stages, and newly defined classes are being gradually introduced into the preexisting array of available classes. In math, for example, a mathematics committee including instructors from all consortium high schools and colleges began by defining a Tech-Prep Math I class for 11th-graders and Tech-Prep Math II for 12th-graders, adapting and supplementing the Applied Math curricula developed by the Center for Occupational Research and Development (CORD). Actual implementation of applied math classes, however, lagged slightly behind curriculum development. As a result, during 1993-1994 most schools in the consortium had a mix of traditional and newly developed math offerings. For example, at the vocational school in Springfield, the following classes were offered that year:

- ***General Math***. Basic skills, taught largely from a traditional textbook, but incorporating some use of videos
- ***Pre-Algebra***. A traditional course taken mostly by 9th-graders
- ***Pre-Applied Math***. A class mostly for 10th-graders in which instructors incorporate units of CORD Applied Math I
- ***Tech-Prep Math I***. The curriculum recommended for 11th-graders, based on CORD Applied Math II
- ***Algebra I/II***. A two-year sequence based on traditional curriculum, which staff envision will be replaced for Tech-Prep students by Tech-Prep Math I and II
- ***Plane Geometry and Trigonometry***. Pre-existing classes, based on traditional curricula

Other curricula, similarly, are being developed in stages. In 1992, the consortiumwide science committee developed a plan for the physical sciences, calling for teaching the CORD Principles of Technology curriculum in segments over three years beginning in 11th grade and extending into the first year at the community college level. A further recommendation on life and natural sciences curriculum is planned. The communications committee issued a report specifying the broadly defined reading and writing skills students should develop, but it does not seem that consensus has been reached on the kinds of curriculum materials to be used in English classes taken by vocational students.

From the standpoint of students, the effects of curriculum development efforts are emerging gradually. In theory, vocational students in articulated vocational programs are expected to take applied academics classes. Students currently encounter schedule conflicts and limits on the availability of class sections. However, they still have the option to take college-prep or vocational-track classes. In one focus group made up of identified Tech-Prep students, for example, some students said they were taking college-prep English and biology, others vocational English and biology. With efforts focused on the 11th-grade Tech-Prep Math I classes, in 1993-1994 younger students who were not ready for that curriculum took more traditional math classes. In some cases, because classes of Tech-Prep Math II were not yet offered, more advanced students were placed in the new applied math class although they were ready for more advanced work.

Because implementation of new curricula requires changing teachers' classroom practices as well as providing new equipment and classroom materials, change is gradual. The pace of change is understandably varied across consortium schools and even across subject areas within schools. In Springfield, cumbersome city procurement procedures delayed delivery of Principles of Technology lab equipment well into the fall of 1993, forcing physics teachers to rely to a substantial extent on traditional lecture and demonstration methods, while teachers in other consortium districts were already actively engaged in the "lab coaching" methods associated with the CORD course. Some applied math classes in Springfield were being taught with heavy use of hands-on methods--for example, engaging students working together in pairs on solving linear equations using symbolic objects. An applied math class in another district was taught traditionally, however, focusing on abstract calculations of graph slopes and intercepts with no tangible, real-life application.

Progress is perhaps most difficult in English, where individual instructors appear more wedded to their traditional curriculum and teaching styles. An applied communications class in one district--although it was taught with energy and succeeded in holding most students' attention--followed a traditional question-and-answer format, focusing on the identification of sentence fragments. In an applied reading class for a cluster of students from various building trades programs, students had their hands on computers, but the content and style of instruction were narrow and traditional. For example, teachers asked students to make lists of vocabulary words and use them in sentences, and help given to students writing journal entries about their vocational classes focused on word-processing mechanics rather than on verbal expression.

C. RECRUITING, GUIDANCE, AND CAREER DEVELOPMENT

Given the organization of education in the Tech-Prep West consortium, students come to be considered Tech-Prep participants as a result of two decisions. Students first choose a vocational program at the end of eighth grade. After their ninth grade exploratory rotation, they are considered Tech-Prep participants if they respond positively to a school inquiry about their interest in postsecondary education, elect to take applied academics classes, and are enrolled in one of the vocational sequences for which an articulation agreement has been signed. Applied academics classes are only gradually becoming available, however, and students still have the option to take college-prep classes. As a result, in the first few program years students who have been exposed to any part of the full range of applied academics classes envisioned or already implemented are counted as Tech-Prep participants. Applying this standard, the consortium counted 414 Tech-Prep students in school year 1992-1993--all in grades 11 and 12. It appears that in at least some of the individual vocational schools, however, administrators and faculty have not yet come to a clear, common understanding of who is to be considered a Tech-Prep student.

The choices students make that lead them to be counted as part of Tech-Prep are influenced by four sets of staff: (1) middle school counselors: (2) regular high school counselors; (3) high school career counselors; and (4) a special Tech-Prep counselor serving the whole consortium. Middle school counselors continue to focus on the basic choice between college-prep and vocational programs, although Tech-Prep coordinators and other staff, in an effort to overcome traditionally negative stereotypes, have provided orientation and training to heighten their awareness of recent changes in vocational programs and the enhancements associated with the Tech-Prep initiative. High school career counselors arrange for vocational instructors and students to speak at middle schools each year to market their programs--including articulated Tech-Prep programs as well as nonarticulated programs.

Regular counselors at the high schools continue to focus on helping students to choose their academic courses each year to accompany their ongoing vocational program. It appears--at least in Springfield--that these choices are approached flexibly each year, with consideration given to the students' performance, aptitude, schedule constraints, and ambitions for postsecondary education, rather than with emphasis on a mapped-out plan of study required to enter and complete a particular postsecondary program.

The consortium's Tech-Prep counselor informs high school students and middle school and high school staff about Tech-Prep and, more generally, about how vocational programs can lead to postsecondary programs and solid careers. The counselor travels almost full-time among the eight schools, making presentations to groups of students about Tech-Prep, answering questions about college entrance standards, financial aid, and application procedures, and meeting with individual students. The counselor also meets with middle and high school counselors to build their understanding of Tech-Prep and how it may affect the advice they give students.

Other approaches are also used to attract students to Tech-Prep. A summer program to get girls interested in technical careers was held in Chicopee in 1992 and may be repeated in 1994. For three weeks, this full-day program involved 30 eighth graders in hands-on exposure to electrical technology, CAD/CAM, and culinary arts (in part as an opportunity for nutrition education), as well as field trips with a scientific focus. A special brochure to overcome students' fears and reservations about postsecondary study was developed, and open houses for parents are held at most high schools each year.

Efforts to promote career awareness are broadly designed for vocational students in general, rather than specifically for those who meet the criteria to be called Tech-Prep students. The traditional cooperative education program in Springfield, for example, finds paid job placements for about one-third of the seniors in fields other than health, but does not emphasize workplace training; students are generally selected if they have already mastered the skills the employers need. All Springfield students in the health aide program continue to participate in a very structured three-year clinical training program at nursing homes and hospitals. Employers serving on the Tech-Prep West business and industry council have arranged occasional workplace tours for groups of students, and work with vocational school career counselors to arrange individual brief job shadowing experiences (about 20 during 1992-1993, for example, for Springfield students). In one of the other vocational high schools, a technology lab (similar to the Gainesville middle school facility described in Chapter II) has been installed to support the ninth-grade exploratory program.

D. GOVERNANCE AND RESOURCES

A steering committee, supported by a business and industry council, guides overall Tech-Prep development. The 13-member steering committee is composed of a coordinator from each of the colleges; administrators from each high school (principals or directors of vocational education or curriculum) and an administrator from each college (a Title III coordinator, a dean of institutional research, and an articulation coordinator). This committee meets formally about four times per year. The 16-member business and industry council plays a largely consultative role. For example, it reviews curriculum recommendations and plans developed by committees of high school and college faculty. Its members--which include a local PIC director, a hospital education director, and representatives from major corporations such as Coopers and Lybrand, United Technologies, Trak

International, and American Saw and Manufacturing--sometimes play individual support roles as well. One member, for example, hosted staff from the Springfield vocational school for a day-long seminar on managing institutional change.

Ongoing planning and coordination have been the responsibility of three coordinators, one from each of the three original college members. The post of consortiumwide coordinator and fiscal agent rotates each year from one college to another. About three-quarters of the 1993-1994 grant of $267,000 was used for the coordinator staff and clerical support for the lead coordinator (with the remainder largely devoted to the Tech-Prep counselor, staff development costs, and salary supplements for high school curriculum implementation liaisons). Each of the coordinators plays an active role in monitoring the progress of articulation, as well as in curriculum development and implementation. For example, coordinators try to stay informed about the extent to which the relevant high school teachers who have participated in staff development workshops have begun using new materials and teaching approaches, and follow up with administrators if they note a slow pace of change.

Development of applied academic curricula has been pursued by a set of three curriculum committees (for math, science, and English). Each committee includes high school and college teachers in the particular subject area and is chaired by one of the three college coordinators. These consortiumwide committees prepare recommendations. It is then up to the individual school administrators and teachers--guided, coaxed, and supported by the coordinators--to assemble new materials, rearrange class schedules, and modify what goes on in the classroom.

The brief initial observation of Tech-Prep in the Springfield district suggests one of the dilemmas that may face many other consortia and schools. Two parallel efforts, guided by separate committees, are under way in Springfield. One effort is to develop and implement applied curricula in math, science, and English, and to attract as many students as possible into them. The other effort is to integrate vocational and academic instruction, mostly by clustering students by vocational program in academic classes that will somehow be tailored to their technical direction. Staff responsible for integration acknowledge, however, that there are too few students in each vocational area to support clustered academic classes at all skill levels. Instead, their current plan is to have math teachers, for example, instruct building trades students at varied math skill levels in the same class, thus "accelerating slower students and narrowing the gap." This approach to integration may be working at cross-purposes with Tech-Prep efforts to develop a sequence of applied academics classes extending to advanced levels.

XII. EMERGING ISSUES

The consortia described in the preceding chapters are using diverse approaches to implement Tech-Prep, for several reasons. The consortia clearly operate under different local circumstances and constraints, and local Tech-Prep leaders interpret the potential of Tech-Prep and the best uses of Title IIIE funding differently. The diversity of implementation approaches we observed in the first of four annual site visits suggests important issues for the future, and resolving these issues is likely to affect the ultimate contribution that Tech-Prep makes in these sites to strengthening students' career preparation. Our discussion of these issues here is not intended to suggest how the consortia will or should ultimately resolve them, because they are continuing to develop Tech-Prep. We will continue to observe the consortia's progress in three subsequent visits extending through 1996.

The issues these consortia face, as observed early in their program development, merit discussion now because these issues will face consortia throughout the country. In addition, they may have some bearing on refinement of federal policy, as well as state and local decisions and priorities. This final chapter contributes to such deliberations by raising and exploring six key questions about the direction of Tech-Prep:

1. Whom is Tech-Prep for?
2. How central is articulation to Tech-Prep development?
3. How can consortia make programs of study a meaningful feature of Tech-Prep?
4. What are the implications of alternative strategies for introducing applied academic instruction?
5. How much will Tech-Prep change postsecondary programs?
6. What contributions can be expected of employers in the development of Tech-Prep programs?

1. Whom Is Tech-Prep for?

Tech-Prep was originally defined as a program option that would be distinct from both the College Prep and vocational tracks. College Prep programs would lead to the attainment of a baccalaureate degree, vocational programs to work-force entry right after high school, and Tech-Prep programs--at least initially for most participants--to advanced training and an associate's degree at a community or technical college. The emphasis on technology in Dale Parnell's concept of the program and in the federal authorizing legislation distinguished Tech-Prep from traditional vocational programs (for example, those in crafts, trades, and human and business services) and from the academic programs followed by students bound for four-year colleges. Early advocates viewed Tech-Prep as a cohesive program for students in the middle two quartiles of academic achievement--the "neglected majority."

Tech-Prep implementation strategies are far more diverse, however. This diversity raises the question of whether federal policy should promote a particular interpretation of Tech-Prep or continue to support multiple approaches. Elements of the early Tech-Prep model--such as technical preparation, programs of study with a particular career focus, career awareness activities, applied academics, and concentration on middle-quartile students--are emphasized to quite varying degrees by different consortia. The consortia have also adopted diverse views about who is a "Tech-Prep student." Some consortia have made a deliberate decision not to identify Tech-Prep students. For those that identify Tech-Prep students, the definitions vary. Some consortia include any student who takes an applied academics course, and others include all students who take articulated vocational courses. Others include only students engaged in more comprehensive occupationally focused programs of study that delineate their academic and vocational courses in high school and community college, as envisioned by Parnell (Silverberg and Hershey 1994). Some consortia contend that Tech-Prep students can only be identified after they have successfully completed at least part of the educational path to a career--for example, when they matriculate to a community college.

To some extent, these target population definitions and implementation approaches reflect different stages of development. Some consortia start to implement Tech-Prep by articulating individual vocational courses and consider students who take such courses "Tech-Prep students." Later, these same consortia may identify sequences of existing secondary and postsecondary vocational courses relating to specific career directions and amend their definition of Tech-Prep participation to match their capacity to guide students into these sequences. Still later, consortia may develop curricula that weave occupationally relevant material into academic skill instruction. Some consortia, of course, may approach full implementation of their program vision more quickly, if some Tech-Prep components had already been created before Title IIIE funding was received. If consortia are at different stages in an evolutionary process, we are likely at any given time to observe what appear to be quite different implementation approaches.

Variation in Tech-Prep implementation, however, also reflects real differences in opinion about what purposes and which students should be served by Tech-Prep. Some educators view the features associated with Tech-Prep as potentially benefiting *all* students; others consider Tech-Prep most appropriate for certain groups. Some consortia appear to have made conscious strategic decisions about the target population for Tech-Prep. In other cases, local circumstances and the origin of Tech-Prep grants in vocational education legislation seem to have precluded consideration of the target population issue. We have identified three implementation models that correspond to three different targeting objectives, each with its advantages and disadvantages:

- A focus on ***selected occupations***
- A general ***upgrade of vocational education***
- Implementation of ***general systemic reform***

The Selective Occupations Model. In the selective occupations model, consortia implement a few thoroughly defined Tech-Prep programs of study, usually for high-tech occupations. Business and industry representatives are typically active partners in choosing the occupations and structuring the program. Students are selected carefully, although not strictly on the basis of grades, to maximize their chances of success in the math and science courses (which are typically more rigorous than what they might otherwise have taken). This model has been endorsed by such states as Ohio and West Virginia and is typified in the Dayton and Logan in-depth study sites.

This focus on structured programs in just a few high-technology occupations has some important advantages:

- ***High Status.*** The selected occupations model clearly distinguishes Tech-Prep from traditional vocational education and thus can help it escape the stigma often attached to these programs. Careful selection of students, as well as strong employer endorsement and involvement, can create a strong positive image of the program in the community. In sites using this approach, we observed that students take pride in their special status.
- ***Feasibility of Comprehensive Programs of Study.*** By implementing just a few programs, consortia can define programs of study explicitly and create common schedules for a small group of participating students.
- ***Ease of Student Identification and Monitoring.*** Because all students take a common core sequence of classes, Tech-Prep consortium staff can readily identify participating students and chart their progress.

However, it remains uncertain whether consortia implementing this model can involve more than a small number of students without sacrificing program quality. Program quality might be compromised, for example, if the consortia expanded Tech-Prep into less technology-oriented occupations, if they became less selective in choosing students, or if an increase in the number of participating students undermined the cohesiveness of their programs of study because of course scheduling problems.

Upgrading Vocational Education. Other consortia have chosen to upgrade vocational education in general, hoping to affect most or all students who choose vocational education programs by improving their academic skill attainment and encouraging them to continue to postsecondary education. Consortia that adopt this approach, such as those in Springfield and Hartford, focus on articulation and guiding vocational students into suitable applied academic courses when possible. Under this model, students may not identify closely with Tech-Prep or feel part of a special new program, because the major choice they face is still between college-prep and a vocational track or school. Their vocational courses and their applied academic classes may differ somewhat from classes they would have taken in the past, but most likely in ways that the students cannot readily identify as part of a new, higher-status program.

Viewing Tech-Prep as a way to upgrade vocational education has some benefits. The originally anticipated technical focus of Tech-Prep is achieved most naturally in technically oriented vocational programs. The students enrolled in particular vocational programs provide natural groupings of students for whom efforts to integrate academic and vocational instruction can be made.

However, this approach also faces some constraints. Trying to adjust master schedules so that all vocational students can take applied academic courses can be very difficult, as shown by the experience of several study sites. Despite the development of articulation agreements, parents, students, and employers may not perceive that students are enrolled in anything different or special, particularly when Tech-Prep efforts are aimed broadly at all vocational programs rather than a select few. Consortia that adopt this strategy may thus find that even improved vocational programs and their students have difficulty escaping the stigma often associated with vocational education.

One approach to offsetting this potential weakness is linking the upgrading of vocational education with an emphasis on technology education for all students. In the Gainesville consortium and in one school in the Springfield consortium, elaborate technology centers have been opened that provide stimulating, engaging opportunities for students to explore a wide range of technical fields. In Gainesville, the technology center course is an elective for middle school students and attracts a wide range of students. In the Springfield consortium school, all vocational students take an introductory technology course at the center, but the course is also taken as an elective by others, and has generated favorable publicity for vocational programs.

Systemwide Reform. Consortia that apply this model (such as Salem and Fresno) reject the idea that Tech-Prep should be targeted to any particular group. Instead, they contend that programs of study, career development activities, and applied approaches to instruction should be available to all students. Consortium staff envision that, when their plan is fully implemented, all high school students will select a program of study or career cluster suited to their general career interests, and applied learning techniques will be incorporated into academic curricula for students of all ability levels.

In the short term, however, these principles are extremely difficult to realize. Vocational courses may be the only distinction of occupational focus among programs of study at the secondary level, and even that distinction may not always be clear, because vocational courses are often an option rather than a requirement. Despite ambitions to bring more applied instructional approaches to all students, applied academics principles may be most evident in a few courses offered as alternatives to traditional academic courses, rather than being infused into all classes. However, applied academic classes in these communities are likely to attract a wider range of students than under the other two models, because they are open to any student. Although most students taking these courses come from vocational programs or the general education track, high-achieving students may also choose them--taking Principles of Technology in 10th grade, for example, as preparation for Advanced Placement physics. As a result, applied academic instruction may neither be focused on a core of "program participants" nor truly affect all students.

This model also raises questions about the aim of federal policy and whether this approach uses Tech-Prep resources as envisioned in the federal legislation. Rather than improving vocational education directly and focusing on technical fields, as envisioned in the Title IIIE legislation, the Tech-Prep development effort may be diffused over the full student population, and the impact of this broad reform strategy on the experiences of individual students may be quite limited for some years to come.

2. How Central Is Articulation to Tech-Prep Development?

Articulation is the most commonly implemented Tech-Prep component. By fall 1993, secondary and postsecondary members in almost all consortia funded by Title IIIE grants had signed articulation agreements linking high school and college courses and, in some cases, related sequences of courses (Silverberg and Hershey 1994). In the 10 in-depth study sites, articulation has generally received more attention than developing and implementing applied academic courses, programs of study, or career exploration activities. This emphasis on articulation has persisted for several reasons:

- Articulation agreements are required under the Perkins Act as a condition for Title IIIE funding.
- Most consortia (about 60 percent) had previous experience developing articulation agreements before Tech-Prep legislation and a process for developing new agreements.
- Articulation is easy to arrange, usually involving only a short-term effort to review high school and college courses and make minor adjustments.
- Articulation agreements are tangible signs of progress and successful collaboration, which are particularly important in the early stages of Tech-Prep development.

These reasons probably account for the early emphasis on articulation, but questions remain about the long-term contribution of articulation to students' achievement of Tech-Prep objectives. Does articulation encourage students to earn a two-year associate's degree or occupational certificate? Does it provide students, as suggested in the Tech-Prep legislation, with "progressive achievement leading to competencies" in math, science, and communications? Do articulation agreements really promote levels of technical preparation that would not be achieved in the absence of the agreements?

Such concerns persist because, in most cases, articulation involves only establishing equivalences between secondary and postsecondary vocational courses so students can earn college credit in high school. This focus on vocational course-to-course articulation leaves several concerns unaddressed:

- ***College Concerns About Student Skills.*** Many community college instructors complain that first-year students lack the basic academic skills needed to master advanced technical material. Articulating a single vocational course does not address this problem.

- ***Low Rates of Student Use of Articulation.*** Employers want students to achieve high-level technical competence, but some students retake articulated courses at the college level rather than obtain credit and jump ahead to more advanced course work. This outcome is often due to lack of promotion of articulation--sometimes because teachers fear their high school courses are not really college equivalents.

- ***Weak Inducements to Attend Consortium Colleges.*** The opportunity to earn advanced credit at a two-year college is not always a strong incentive for students to enroll there, even when articulation is promoted as a benefit of Tech-Prep. In some study sites, many students still plan to attend four-year universities or other nonconsortium colleges in which they cannot obtain articulated credit.

Several strategies have emerged in the in-depth study sites to address these concerns: (1) use of competency tests as a condition for earning articulated credit; (2) expanding articulation to include four-year institutions; (3) coordination of articulation across community colleges to expand students' opportunities; and (4) extending articulation to include academic classes.

Competency tests can help reassure both high school and college teachers about students' skill levels. Secondary teachers may be more willing to promote articulation if they are confident that only students who have really mastered required competencies are granted credit. To this end, several sites require evidence of skills as a condition of credit award. In Salem, for example, all students must pass a competency assessment to earn college credit. In Dothan, high school students can earn articulated credit if they receive a grade of A or B, but if they get only a B they must pass a "challenge test."

Expanding articulation beyond the traditional high school-community college arrangement might encourage students to attend community colleges. Agreements that make it possible for students to apply their articulated credits at the community college and later at a university can reassure parents and students that pursuing a community college degree does not limit the option to pursue a four-year degree. This strategy can expand students' postsecondary options and encourage them to begin postsecondary work with advanced technical training at a community college, rather than entering a four-year liberal arts program without a clear occupational objective.

Agreements are also possible under which credit can be earned at multiple community colleges. Such arrangements allow students greater flexibility in choosing postsecondary institutions, without jeopardizing credits. This strategy may be particularly useful in large metropolitan areas with several community colleges in close proximity. A few states are beginning to consider statewide articulation agreements for this purpose. These efforts will introduce common competency objectives across institutions for the same educational programs--a movement that would be consistent with federally endorsed and funded efforts to develop national skill standards.

Finally, broadening articulation to include academic courses could result in greater emphasis on raising academic standards and encourage students to be as concerned about performance in academic classes as in vocational classes. This approach could have two variants. Consortia could simply establish equivalences between high school and college academic classes and conditions for granting college credit as they do for vocational classes; this approach is currently followed in the Hartford consortium. A more far-reaching approach is to link award of college credit to successful completion of both vocational and academic classes in the high school stage of a defined program of study; this approach is followed in the Gainesville consortium. Both approaches could allay concerns about Tech-Prep students' level of preparation for college work--but only if articulation is carried out with strict adherence to college-level standards for awarding academic credits.

3. How Can Consortia Make Programs of Study a Meaningful Feature of Tech-Prep?

Tech-Prep advocates have long emphasized the importance of a coherent plan to guide students' course selection through the high school and community college phases of a career-oriented program. They have argued that a program of study--called a "sequential course of study" in Title IIIE of the Perkins Act--can have several important benefits for students:

- Encouraging students to think about their future and how their education is going to prepare them for it

- Discouraging students from "grazing" among available high school vocational courses or academic electives and taking a series of unrelated, introductory courses that do not help them progress to higher skills

- Increasing students' chances of moving rapidly into advanced level classes at the postsecondary level and developing a strong grounding for their chosen career

To fulfill these objectives, however, programs of study should represent meaningful, informed choices. Before choosing among programs of study, students should be exposed to the career options they represent, likely salaries and working conditions in these occupations, and the type and amount of education the careers require. A program of study is meaningful only if it is actually used to guide course selection, at the time a student first selects it as well as in later semesters. Programs of study must also represent real alternatives; if students with diverse career interests all have the same program of study in high school--the same English, math, science, and social studies classes--the process of choosing a program of study will seem an empty exercise. Given the importance that Tech-Prep proponents place on integrating academic and occupational learning, programs of study should ideally include both academic and vocational courses, tailoring academic course choices, to the extent possible, to students' career interests. Finally, if students are to see their program of study as a plan that extends to postsecondary education, the program must clarify what specific course sequence the student would pursue in college.

Our preliminary observation of the 10 consortia in the in-depth study shows that programs of study often depart from this ideal. In some consortia, a conscious decision has been made to avoid even defining programs of study that determine students' course sequences. Sites that have defined programs of study vary along several dimensions:

- ***Coverage of College Level.*** In some sites, students choose a program of study that extends through a community college occupational program. In other sites, the programs of study encompass only high school courses.

- ***Degree of Emphasis on Adherence to Program.*** Some programs of study are treated as individualized plans that are meant to be carried out. In other sites, they are only suggestions of courses relevant to a career direction, and students' actual courses commonly deviate from the suggested sequence. Guidance counselors use programs of study in different ways. In some sites, they offer students preprinted charts showing available programs, and students consciously choose one. In other sites, counselors use defined programs of study as guides for themselves but do not review them with students.

- ***Comprehensiveness.*** Some consortia specify all academic and vocational courses for programs of study, while others include only a vocational course sequence and applied academics classes. In some sites that include applied academics courses in all defined programs of study, the only distinction may be which vocational course a student takes.

Variations in programs of study reflect consortium leaders' views of their purpose. When staff view programs as a way to encourage students to prepare for the general demands of higher education and the workplace, staff may use the programs simply to get students to take higher-level academic courses, rather than emphasizing specialized course sequences for particular occupations. When consortium and school staff are most concerned about improving student interest and achievement in academic classes, they may include applied academics courses in all students' programs and direct students into these classes. If career planning is viewed as most important, programs of study are more likely to include both secondary and postsecondary courses, to give students a clear picture of the overall sequence they will follow to a target occupation.

Two constraints have made it necessary for consortia to choose among these possible priorities:

- ***Sensitivity About Tracking.*** Defining a sequence of courses related to a target occupation can evoke concerns about tracking among school personnel and parents. In some consortia, counselors have feared that Tech-Prep might be an inferior track that forecloses educational or career options, and they therefore put little priority on resolving scheduling problems so students can adhere to a program of study.

- ***Lack of Resources.*** Small or financially strapped districts have difficulty offering variety in vocational or academic courses, and are thus unable to create clearly differentiated programs of study. Even if programs of study are distinct, districts may be able to offer so few sections of some key classes that scheduling difficulties prevent many students from following their program. These scheduling problems are likely to be particularly difficult for consortia that see Tech-Prep as affecting all or most high school students, rather than a small group taking programs centered on occupational courses.

The in-depth study sites offer examples of several approaches or concepts for overcoming these constraints:

- Compensating for lack of in-school variations in course offerings by emphasizing workplace experiences related to students' career interests
- Busing students from small or rural districts to a consortium college for intensive summer programs relating to their career interests
- Developing some programs of study only in certain schools, and busing interested students to these "magnet" programs
- Combating negative impressions of Tech-Prep by providing students, parents, and counselors with explicit charts depicting both secondary and postsecondary components of programs of study, underscoring that Tech-Prep is designed to lead to higher education

4. What Are the Implications of Alternative Strategies for Introducing Applied Academics?

Virtually all Tech-Prep consortia report that they have implemented curricula emphasizing applied learning. Most schools have focused on applied academic curricula and instruction to help students master scientific, mathematical, and English language skills and link these skills to practical applications. In some consortia, introduction of applied academics curricula is the most apparent change associated with Tech-Prep to date. Emphasis on applied academics is due in part to language in the Title IIIE legislation that encourages adoption of such curricula, and perhaps in part to effective marketing of packaged curricula nationwide. Applied academics curricula, when well implemented, demonstrate the relevance of physics, mathematics, and communications skills to the world of work, engaging students in active learning through group projects, discussion, laboratory experiments, and other hands-on activities to help them grasp otherwise abstract concepts and clarify their real-world applications.

Various approaches have been taken to introducing applied academic curricula. Local approaches vary with regard to three issues that have potentially important implications for school staff and students: (1) Whom is it for? (2) How should curriculum be developed? and (3) Which teachers should be involved?

Whom Is the Applied Academics Approach for? Consortia have made different decisions about which students are the target population for applied academics curricula and instruction. Some consortia explicitly create applied academics classes for vocational students--either all students enrolled in any vocational course, or only those in specific occupational courses designated as part of a Tech-Prep program. Other consortia--typically those that view Tech-Prep as an element of systemic reform--prefer to make classes based on applied curricula broadly available to all students and rely on counselors to guide students to these classes. Students who actually enroll in applied academics classes are rarely drawn evenly from across the full student population, however. In the sites we have observed, counselors usually view the applied courses as most appropriate for students with lower academic performance. In a few cases, however, staff have promoted applied technology or science courses as rigorous and challenging alternatives to traditional ones and encouraged a wide variety of students, including university-bound ones, to take them.

Choice of the target population can determine whether the applied courses are perceived by students, faculty, and parents as challenging or remedial. Schools that use applied academics instruction for vocational students sometimes offer courses that were originally designed for lower grade levels. For example, the Center for Occupational Research and Development (CORD) Applied Math I curriculum, designed to be challenging for ninth-grade students, is used across the 10 study sites, at all grade levels in high school as well as at the college level. Achieving acceptance of packaged applied academic curricula for use with a broad range of students may be more difficult if the applied courses are used at first for students at higher grade levels, because the courses and the applied approach may become stigmatized as remedial.

How Should Applied Curricula Be Developed? Development of applied curricula has been approached in three ways by the consortia included in the evaluation:

- ***Adoption of Packaged Curricula.*** Some consortia and schools have purchased off-the-shelf curricula for particular subjects and used them as the basis for whole courses. This has most commonly been the case with CORD's Principles of Technology.
- ***Local Curriculum Development.*** In some schools, faculty have developed entirely new applied courses on their own.

- ***Incorporation of Packaged Curriculum Modules or Materials.*** **Other schools mix the first two approaches. Teachers incorporate selected modules or instructional units from available curriculum packages into more traditional materials and approaches that they have used in the past.**

These varying approaches can have different consequences for teachers and students. Packaged curricula minimize the course-planning effort for teachers; in some schools in the study sites, this advantage has inducted some teachers to accept an assignment to teach applied academics courses. On the other hand, adopting commercial packages requires less interaction and collaboration among academic and vocational teachers than a local effort to develop applied courses, and it may not engage teachers as fully in rethinking how they teach. Moreover, courses built entirely around off-the-shelf curricula are often formally labeled by a district or a state education agency as "applied." In some states, four-year colleges and universities do not recognize applied math, science, or English courses as academic high school credits for purposes of admission decisions, which stigmatizes the courses. This prospect has led many consortia to adopt the more diffuse strategy of incorporating applied learning techniques and materials more selectively into traditional course curricula.

Who Should Teach Applied Curricula? Consortia also differ in their decisions about which teachers should use newly developed or adopted applied academics curricula, often because of state requirements. Although vocational instructors might be well equipped to create occupationally relevant applications of academic skills in the classroom, most consortia assign academic teachers to teach the new curricula. Particularly when the curricula are locally developed by academic teachers, this decision sometimes yields classes in which curriculum and teaching methods deviate little, in classrooms we observed, from traditional methods of academic instruction. In some cases, academic teachers are assigned because academic credit can be awarded only for classes taught by certified (academic) teachers. In other instances, vocational instructors are reluctant to teach academic skills. However, schools that rely on state vocational funding to implement applied academics may find it possible, advantageous, or even necessary to assign vocational instructors to these courses and to incorporate applied academic modules into vocational instruction. For example, the California vocational education system funds only courses that teach occupational skills. To comply with this regulation, a vocational high school in the Fresno consortium is teaching units of Principles of Technology in the building and construction course and the heating and air-conditioning course.

5. How Much Will Tech-Prep Change Postsecondary Programs?

Efforts to develop Tech-Prep thus far have had more visible effects on secondary education than on community college programs. This difference is due in part to the relatively early stage of development observed in the first round of evaluation site visits. However, other institutional characteristics of community colleges contribute to this difference as well and raise some questions about the extent to which long-term Tech-Prep development is likely to change postsecondary programs. In the longer term, the open question is whether community colleges will only (1) help to strengthen secondary education and improve the readiness of high school graduates to enter existing postsecondary programs, or also (2) enhance the rigor of college programs and the skill levels that their graduates attain.

Community colleges have clearly played key roles in the 10 consortia included in this evaluation. They have served as fiscal agents, and usually lead consortiumwide governance bodies and committees involving school, college, and employer representatives. In several cases, college staff have been active in reviewing and revising secondary curricula, and in extending the scope of articulation. Community college coordinators have been instrumental in arranging staff development, and have helped to establish links between consortium high schools and employers.

However, change in what colleges teach or how they teach seems thus far to be the exception rather than the rule. Most changes in instruction and organization of courses have taken place in high schools. In a few cases, colleges have adopted some principles of applied academics in mathematics classes, and some examples of creative college work on integrating vocational and academic learning have been noted. However, colleges have so far contributed mostly to changing what goes on in high schools. This pattern is due to three factors:

- ***High Schools Are Most Often the Focus of Concern and Debate.*** Dropout rates for public high schools are widely publicized, and standardized test scores are often viewed as a barometer of school effectiveness. The effectiveness of colleges is less scrutinized. The incidence of students leaving college is not usually viewed as a reflection of college practices. In most communities, this focus on high school performance leads both secondary and college partners to concentrate their early efforts on finding ways to make high schools more effective.

- ***College Faculty Autonomy Can Make It Difficult to Mobilize Them for Change.*** Faculty in colleges and universities generally have more discretion over what and how they teach than high school teachers, and instructors are often more attuned to their disciplines than to colleagues in other departments. As a result, the concept of a comprehensive, occupationally oriented program of study linking academic and technical courses has received little emphasis, and efforts to integrate academic and technical instruction are unusual.

- ***Colleges Are Uncertain How Tech-Prep Will Affect the Challenges They Face.*** With Tech-Prep students in most consortia still in their high school years, faculty at some colleges remain uncertain whether:

  - Tech-Prep students will really be more prepared for college-level work than past high school graduates.

  - Enthusiasm for getting Tech-Prep students to enter community colleges will create pressure to lower college standards.

  - Improved preparation of high school students will really make it possible for college faculty to teach at a more rapid pace and help students develop more advanced skills.

  - Investing college resources in more faculty and improved technical facilities will be warranted by increasing enrollments and possible within funding constraints.

  - Large proportions of their students will continue to be older adults rather than recent high school graduates, thus minimizing the impact that even a successful Tech-Prep has on the preparation of incoming students.

Some college faculty and administrators already perceive the value of Tech-Prep, whatever the outcome of these uncertainties. Teaching academic subjects with a more applied approach, some faculty realize, can serve their current student population better. In some study sites, plans are being discussed for creating honors programs or advanced-skill degrees to accommodate students who enter with strong preparation and attain more advanced skills than is typical in current associate degree programs. For some faculty, greater cooperation with secondary school districts has opened up rewarding opportunities for collaboration and consulting. However, the likelihood of widespread changes in college programs as a result of Tech-Prep probably hinges on the quality of Tech-Prep high school graduates over the next few years and the number of them who seek an associate's degree.

6. What Role Can Business and Industry Be Expected to Play in Tech-Prep?

Although early definitions of Tech-Prep and its authorizing legislation identified educational institutions as the central consortium members, in many sites schools and colleges seek out the involvement of employers, responding to several sources of encouragement. Literature on the role of employers as partners with schools in European apprenticeship systems has fueled interest in getting American employers to work with schools. Reports of employer roles in a few well-publicized U.S. youth apprenticeship programs have reinforced support for giving employers key roles in helping students develop technical and general workplace skills and in guiding the objectives of in-school activities. The School-to-Work Opportunities Act of 1994 has increased pressures to involve employers in local partnerships.

In the nation as a whole and in the 10 in-depth study consortia, business and industry are indeed providing support for Tech-Prep. Nationwide, three-fourths of local coordinators reported in fall 1993 that their consortia were receiving support from such groups (Silverberg and Hershey 1994). Consortium leaders in the 10 in-depth study sites consistently stressed the importance of cooperation, support, and active involvement of employers. Employer or industry representatives sit on governing boards, promote Tech-Prep, and in some cases help to select target occupational areas. Two central issues remain open, however, concerning the involvement of employers in Tech-Prep consortia:

- Can employers provide workplace experiences as a routine or required part of Tech-Prep students' experiences?

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- What role can employers play in strengthening school-based components of Tech-Prep?

Feasibility of Requiring Workplace Experience in Tech-Prep. Employers already offer workplace experiences in a variety of ways that promote the aims of Tech-Prep consortia. In many consortium schools, employers continue to provide workplace opportunities through traditional co-op programs. Occasional or short-term job-shadowing experiences are sometimes offered by employers to help expose students to workplace environments. Some consortia have developed occupationally focused academies that include low-intensity volunteer work or more intensive workplace training or internships.

However, it appears that only in rare Tech-Prep consortia will employers be able in the near future to expand this role to make substantial workplace experiences routine for all Tech-Prep students. This conclusion is based on four observations:

- ***Arrangements for Systematic and Intensive Workplace Experience Appear in Most Instances to Be Limited to Just One or Two Career Areas.*** These are often in health occupations or manufacturing technology, and benefit from the attention of a few major local employers. Extending workplace arrangements beyond one or two career fields often requires dealing with many small employers, which poses a difficult burden on the limited resources available for coordination between schools and employers.

- ***Employers' Resources for Providing Workplace Experiences Are Limited and Uncertain.*** The in-depth study sites provide examples of even major U.S. corporations backing away from commitments to provide internships or apprenticeships. Even large employers appear willing to take on only a few students for placements involving structured training. Mid-size and small employers are typically willing only to accept students as part-time employees to support production. Although such arrangements can provide income and general work experience, they rarely expose students to a progression of skills related to their school program.

- ***Not All Students Will Fit in the Available Workplace Experiences.*** After-school experiences may be impossible for some students because of family or other extracurricular commitments and transportation difficulties.

- ***Some Consortia Face a Paucity of Local Employers.*** In many locations, particularly in rural areas or in economically depressed urban areas, there may be few local employers relative to the number of students who might be candidates for workplace experiences.

However, creative strategies can expand the number of students who gain some useful workplace experience. By organizing a continuum of workplace experience, including brief worksite visits as well as more intensive placements, consortia can potentially expand the total number of students who participate. Consortia can organize students as volunteers for community-based organizations or other public service, where they can gain some benefits of workplace experience. School enterprises can provide chances to develop technical skills, work habits, and business skills. However, each of these approaches requires a great effort at organization and coordination and is likely to affect only some Tech-Prep students. It would not appear to be realistic, therefore, to impose a rigid requirement that consortia involve all Tech-Prep students in workplace experiences. Even requiring that consortia provide any kind of workplace experience may be inappropriate. Rather than expend scarce resources on developing workplace experiences that may affect few students, some consortia may prefer investing in school-based programs.

Roles for Employers in Strengthening School-Based Components. Employers in some Tech-Prep consortia provide input to school-based program components as well as workplace experiences. Employer involvement has generally focused on:

- ***Technical Curriculum.*** In several in-depth study sites, employers have provided ideas for changing technical curricula and refining definitions of required technical skills.
- ***General Workplace Readiness.*** Employers have arranged and participated in school-based activities designed to enhance students' general workplace readiness--talking to students in school about workplace habits, assisting in mock interviewing sessions, and helping students learn to prepare resumes and job applications.
- ***Equipment and Events.*** Employers in some sites have provided funds for laboratory equipment or special events for Tech-Prep students.

Despite the focus of employers' Tech-Prep contributions on technical curriculum and workplace readiness, employers most often describe basic academic skills as the missing ingredient in new young job candidates. In the sites we have observed, however, effective ways to involve employers in strengthening academic curricula are either given low priority or prove elusive.

To be sure, the study sites provide examples of employers helping with academic curriculum development in somewhat peripheral ways. In some sites, they have arranged for high school or college instructors to visit worksites or participate in worksite internships, to help them become familiar with workplace applications of the skills they teach. In several sites, employers reportedly provided definitions of target competencies to schools. Other than listings of required technical skills, however, employer input usually appears to consist of broad statements about academic skills and the kinds of work-style skills now commonly called the "SCANS skills." The challenge of figuring out what kind of curriculum can cultivate these skills effectively is generally left to school faculty. In most sites, employers' involvement in curriculum development involves reviewing and approving the decisions that teachers have made in adopting or developing new applied academics curriculum.

Although some educators and employers have argued that getting employers involved will help raise academic standards and achievement, school staff in the study sites are often uncertain about how or whether to involve employers more in defining academic curricula and programs of study. Several factors contribute to this uncertainty. Some consortium staff report that employers and educators approach the process of curriculum definition differently. Employers, they report, often focus quickly on narrowly defined skills and thus gravitate to specifying technical skills, while educators might start with broader definitions. Educators assume that curriculum development meetings will involve protracted discussions and that curriculum change is an evolutionary process, while employers are more likely to expect short meetings with tightly organized agendas and to believe that curriculum revision and implementation can be accomplished quickly. Concerns that educators might consider important in discussions of curriculum development--such as funding streams or requirements to accommodate special populations--are often of little interest to employer representatives.

Whether schools and employers will pursue ways for employers to play a more central role in strengthening academic curricula remains an open question. The evidence so far suggests that, to engage employers more deeply, consortia would have to identify contributions employers can make to academic curricula that draw on their strengths and expertise. For example, employers might be asked to identify exercises based on workplace tasks that require application of particular measurement, computational, or more complex mathematical skills. However, our observation to date suggests that while employers commonly provide on-the-job training, they are usually unaccustomed to developing formal curricular materials focusing on basic academic skills. As a result, schools are likely to remain the authors of their own academic curricula, and employer input in this aspect of Tech-Prep is likely to remain limited.

REFERENCE

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